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THE TYNE.*

By A. J. SARGENT.

It sometimes happens that a phrase or word in colloquial use, and of undoubted significance, contains more real geographical suggestion than the obscurer forms of place-names which delight the etymologist. Such a word is Tyneside. The geographer, speaking of the Tyne, may have in mind the actual water or bed of the river, the river valley from source to mouth, or even the whole area of the river-basin. To the Tynesider, his river is the navigable stretch from Newburn to the sea, with the river-side, a narrow strip with a breadth measured by yards, and hardly ever out of sight of the water. If he extends his view to places outside this narrow zone, it is only because they are intimately connected with or depend for their very existence on the river. Above Newburn, the river valley is in a different category; countrified and sleepy, a fit goal for holiday trips. We may make a further division into Tyne above and below Bridges, a distinction again familiar to the local mind; and we shall have a very fair basis for geographical analysis. For some purposes, we must also add, as an essential part of the Tyne valley, the Wash, the old pre-glacial valley of the Wear; though the former river is now represented only by a tiny stream.

From Newburn to the Bridges there is a strong contrast between the two banks of the river. On the north is a steep and fairly uniform slope, rising to over 300 feet, and leaving only a very narrow ledge of level ground close to the water. On the south is a wide "haugh" of boulder clay and alluvium, through which the Derwent and the little Team meander to join the main river. At the Bridges the heights close in on

* Royal Geographical Society, February 26, 1912. Map, p. 588.

the river, and here we have the twin towns of Newcastle and Gateshead, with the high level viaducts joining the hills and the swing bridge joining the narrow strips along the water's edge.

Below Bridges the high ground gives back a little, and the slope becomes more gentle, especially on the southern side, until we reach the great bend at St. Anthonys, where the river is again flowing through a gorge. Further down, on the north side, the map shows a considerable area of comparatively moderate height and slope, in the basins of the Wallsend and other becks; while on the south side the land opens out into the great clay flats behind Jarrow Slake, which produce to the eye the impression of a silted bed of an old estuary. The slopes, as a whole, below the bend, are relatively gentle, but the 50-foot contour line is never very far away from the north bank; and though 50 feet may not seem much to the geographer surveying the whole area, it means a great deal to the local inhabitant and user of the river. Towards the river mouth this line is as near the water as at St. Anthonys, and on the north side especially we find a steep bank at Tynemouth, with the heights in the background again closing in to form a kind of gorge.

Such are the essential facts of the topography; but the Tyne of the present is but the creation of yesterday, and even some of the high and steep slopes have an artificial origin. The ballast hills, some of which are still marked on the map, were not placed there by nature, and their growth has provided a fruitful source of controversy in the history of the river. Moreover, geographical relationships are strictly relative to human development; they are rarely the same for the present and a moderately distant past; so that a short excursion into history is a necessary preliminary to the discussion of the conditions of Tyneside to-day.

The Tyne has an environment both local and distant; the importance of this environment at the present is mainly or entirely economic; in the early days of our history it was mainly strategic. In both cases the river is a centre of movement, and we may perhaps find the key to its position in Newcastle. It is natural to classify Newcastle as a Bridge town; but in what sense? In the same sense as London—that is, as the lowest point at which the river could be conveniently bridged or forded? No; so far as charts and maps can tell us, there would have been little difficulty in bridging the Tyne much lower down. The mere fact that the Romans seem to have built their wall to Segedunum, on the site of Wallsend, instead of stopping at the obviously defensible position on the gorge of the Ouseburn, and yet did not continue it to the heights of Tynemouth, seems to suggest that the channel was fordable down to Wallsend in Roman times, while lower down it could be defended by a fleet. The early charts of the river bear out this idea. At a later time fords are said to have existed even below Wallsend; but it is impossible to argue from this to the conditions in Roman times, since the changes in the bed of the river,

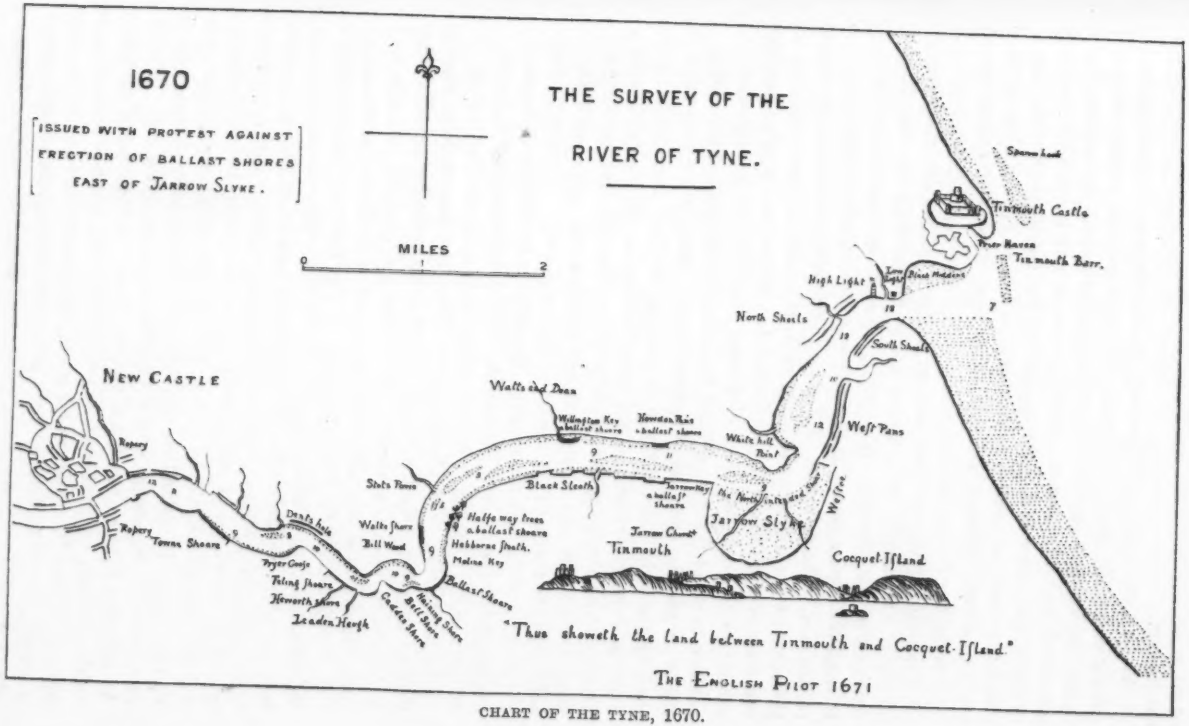


CHART OF THE TYNE, 1670.

so far as history records them, have been in the direction of silting up and shallowing.

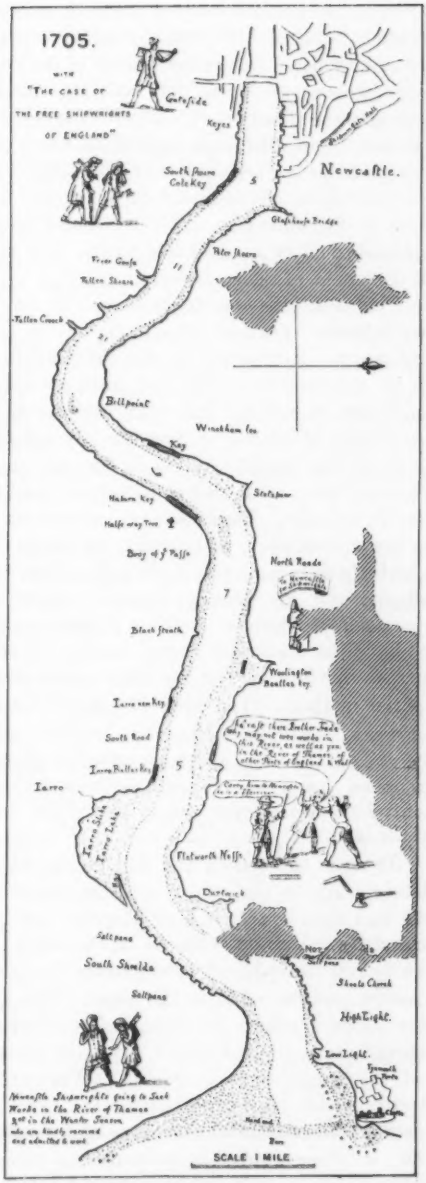
We may perhaps regard Newcastle as the effective head of high-water navigation at the period, and this view receives some support from the known condition of the river above Bridges as late as the middle of the nineteenth century. But it is reasonable to assume that the defensibility of the hills at either end of the bridge, and the fact that here we have a position as near as possible both to the sea and to the main line of their communications northwards, may have been the chief considerations influencing the Roman strategists.

The consideration of Newcastle in relation to lines of movement involves a reference to the Roman roads rather than to the physical structure of the country. It is natural to look on Newcastle as the key to the Tyne gap; a glance at the Roman system may provide a corrective to this idea. The main line of Roman communication northward crossed the river at Corbridge, some distance to the west of Newcastle, and we can trace it southwards by Ebchester, Lanchester and Durham to Binchester, in the neighbourhood of Bishop Auckland. It is clear that any position north of Binchester could be outflanked by way of the valleys of the Wear and Browney, trending north-west. Newcastle lies on a branch road, on the right flank of the main position, its most important function being to cover the river and the route leading to the port of Jarrow or Shields. The Tyne gap itself was probably forested and marshy; communications east and west were not through the gap, but along the heights to the north, in the shelter of the great wall.

In the Middle Ages the strategic importance of the Gap increases, but mainly in the reach above Corbridge. The Scottish raiders had a choice of three routes: by Berwick, by Carlisle, or over Carter Bar and by way of the Rede valley to the North Tyne. The last seems to have been less used on the whole than the other two. Here again the gap from Corbridge to Newcastle does not seem to have been greatly favoured. Thus the Scots under David, in 1346, came by way of Haltwhistle to Hexam, and then struck south-east down the valley of the Browney, until checked at Nevilles Cross, outside Durham. Probably the country round Newcastle was not worth raiding, while the agricultural area round Bishop Auckland, in the south of the Palatinate, was a tempting prize. Again, the raiders who were overtaken at Otterburn seem to have retired from Newcastle, not by way of the Tyne valley, but by the ridge road north-west, as they burnt Ponteland on the way. Newcastle throughout seems to have reference to movement north and south rather than east and west. As throwing light on this point, General Wade, in 1745, found the valley tracks or roads impossible for heavy transport to Carlisle, and so could not cut off the Pretender on his march southward. As a result we have a special Act of Parliament for the construction, at the public expense, of the so-called military road, which runs along the heights, following closely the course of the older Roman road.

Right through mediæval history, and down to the present, the chief significance of Newcastle in its long-distance relations was its position on the great north route from London to Scotland, at the point where that route first came within close touch of the sea. That distinction it still retains, though the rail has superseded the road. In its local significance, in relation to its immediate hinterland, Newcastle can no longer be treated in isolation but becomes part of a larger whole, Tyneside.

The relationship of Tyneside, past and present, to its immediate hinterland may be considered as purely economic. Even for the Romans the river had considerable economic value, as an inlet for supplies for their great garrisons, and perhaps as an outlet for lead, even then worked in the upper part of the valley. In the Middle Ages the character of the hinterland became clearly defined. It was essentially determined by a geological fact — the presence, on both sides of the river, of the coal-measures and of the iron ores and clays which they contained. But the significance of this



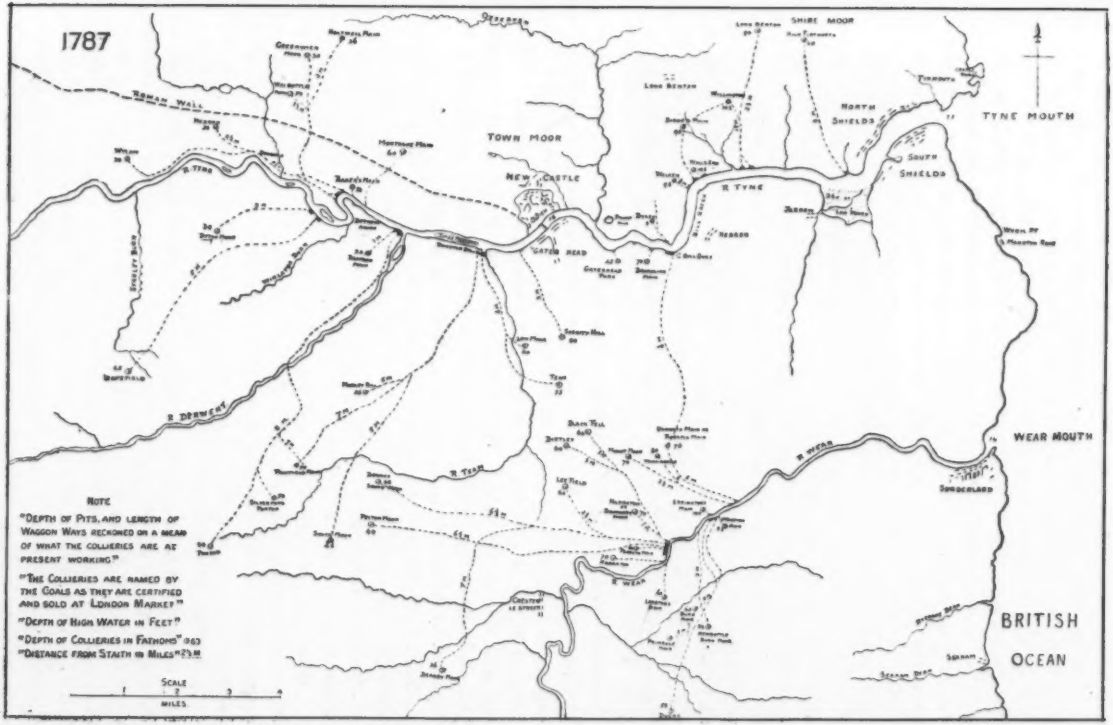
The shaded portion is missing from the original map.

CHART OF THE TYNE, 1705.

geological fact is clear only in the light of geographical conditions. Coal which is inaccessible for commercial purposes is of very small concern to the geographer. Before the coming of the railway, much of our coal was quite useless; some was only available for local industries. When we associate the transport of coal with the packhorse, it is evident that coal can only be handled on a large scale where the mines are close to water navigable for the type of vessel which can carry it to its destination. It was the special advantage of the Tyne that coal could be mined within sight of the waterway, and even on its very banks, and a considerable tonnage could be handled even on the pack-horse system; hence the early development of the coal trade to London.

The packhorse was followed by the two-wheeled cart; this by the four-wheeled waggon, which allowed a somewhat greater range of movement. Here again appears the advantage of the Tyne. The mines lie at a higher level than the river, so that the load is carried for the most part downhill. The next step was to build a rough waggonway, with balks of timber as lines for the wheels; in some cases guide-rails of wood were added, the wheels running outside them. In view of our ancestors' ideas as to what constituted a good road-surface, this was a long step in advance. Then some genius thought of an outside flange of iron, to prevent sideslip; and, finally, the flange is transferred to the waggon-wheel, the iron rail replaces the balk of timber, and we have the railway-waggon and the railway, though without the locomotive. All these changes took place in our area in association with horse-haulage. Next we have the stationary engine hauling by endless cable, and in this connection the structure of the surrounding country leads to the growth of special methods. The force of gravity itself, working through the full waggons, is utilized to haul the empties up the slope to the pithead. This is still the usual and most effective method of working coal for shipment on the Tyne: locomotive haulage on the level stretches, cable control on the steeper slopes, the whole depending on the local relief of the land.

Towards the end of the eighteenth century there was a very full development of the system of waggonways on both sides of the river. We find them coming out at Blaydon and Dunston on the south bank, and at Newburn and Wallsend on the north; but it is worth noting that the largest group of all concentrates on the Upper Wear, following the shortest possible route to the water. The longest of these waggonways was about 8 miles. A comparison with present conditions shows some marked changes. The Upper Tyne still remains a great shipping centre, but the waggonways of the Upper Wear are now directed either to the mouth of that river or to that of the Tyne. The changing conditions of the rivers in relation to the means of transport are largely responsible for this; in other words, the geographical conditions of the hinterland are only relative, and have been modified by human action. The geography of



PLAN OF COLLIERIES OF TYNE AND WEAR IN 1787, SHOWING WAGGONWAYS.

the coal is only to be understood in the light of the structure of the rivers and their banks.

The modern Tyne has cut a channel in the clay which fills up the deep and wide rock-bed of a pre-glacial river. Looked at from the point of view of the district as a whole, the valley of the river is shallow; but the banks, within a short distance of the water, slope sharply in many places. It is the first 100 feet of rise from the surface of the water which concerns us most. To the sharp slope has been mainly due the development here of the typical method of coal shipment, that is direct from the drop or staith to the ship. In some places, where the 50–75 foot contour-lines lie near the water, the waggons are still lowered by cable on to the staith, which is merely a platform built out on piles high above the water. Where the high land gives back a little, or a valley can be utilized, the approach to the staith is down a slighter gradient, so that a whole train-load of waggons can be allowed to run down by its own weight, controlled only by brakes; the empties are then run to a still lower level, and hauled up the "bank" by locomotives. This method is to be seen in full working at Tyne Dock and Whitehill Point, where it is favoured by the structure of the land. At Tyne Dock the 50-foot level is extended by great embankments over the intervening stretch of lower ground; at Whitehill Point the sides of the valley of a small beck provide natural embankments. The river itself, too, is a factor in controlling the method of shipment. In the docks it is only necessary to make allowance for the varying height of vessels; in the river the problem is complicated by the rise and fall of the tide. Where the approach to the water is along the level, either the staith must be served by an artificial incline, or it is replaced by an elaborate hoist working from the quayside.

Thus from the mine to the ship we find a series of special methods of handling coal based in the main on the peculiarities of the topography; geographical influence is strong even in the strictly technical details of business organization.

Whatever the special advantages of the Tyne may be at present, it lacked these in the old days, in so far as it was not navigable for sea-going ships. Much of the coal was first loaded into barges or keels, and then raised into the ships; and the keelmen are an important fraternity in the early history of the river. The full utilization of the waterway dates only from the last fifty or sixty years. The state of the channel was a burning question of local politics in the eighteenth and early nineteenth centuries. The improvement of the river failed to keep pace with that of the ships which used it. The early charts show us a winding channel, full of shifting banks, with a bar of 7 feet at its mouth, and a low-water depth of as little as 6 feet in some reaches between Jarrow and Newcastle. The bar has vanished, and it is hard to imagine that within the memory of Tynesiders still living a man has walked at low tide across the entrance. Now we have a deep-water canal, with a channel of some 30 feet to the

THE TYNE, LOOKING WEST FROM BILL QUAY.

THE TYNE, LOOKING EAST FROM BILL QUAY.

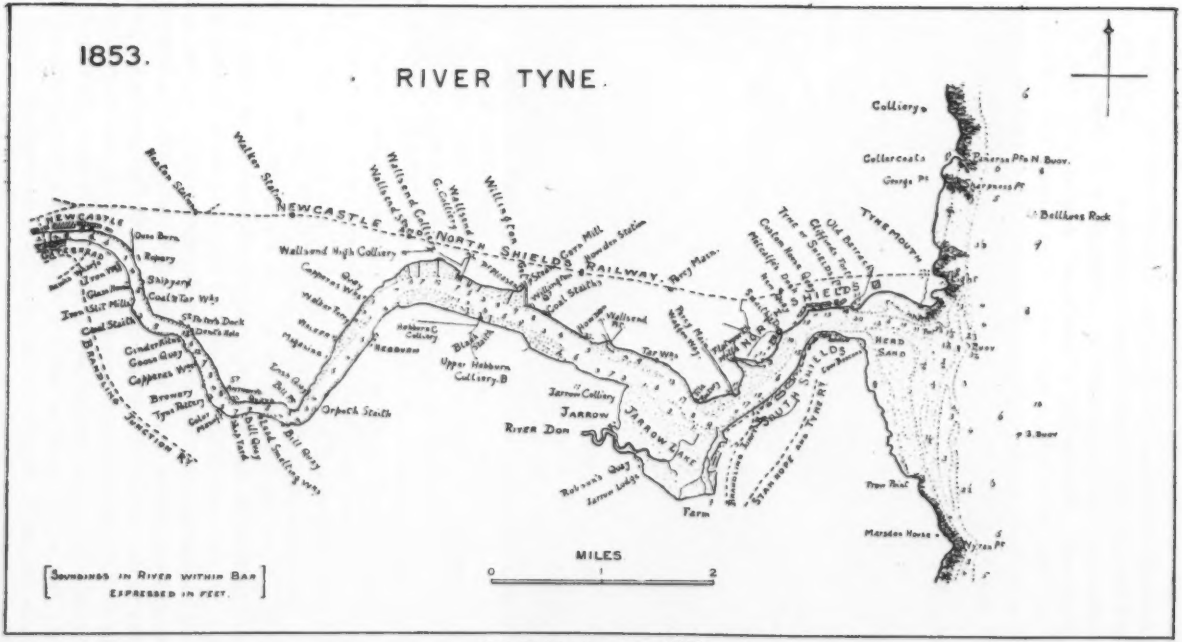


CHART OF THE TYNE, 1853.

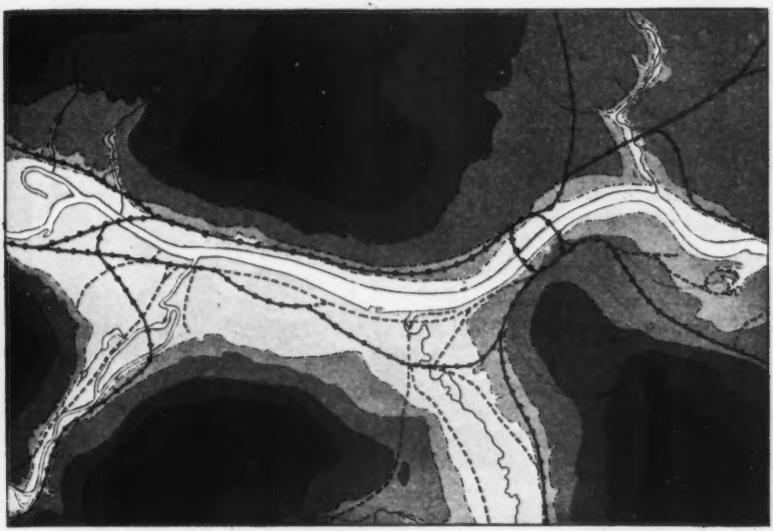
Bridges and of over 20 feet at low water for a long distance above; while the process of deepening still continues. The river has been trained and dredged, and the clay scooped out into a uniform groove. Rock was only encountered at a few points, as at St. Anthonys and Bill Quay, where the rock is exposed. Whitehill Point, now merely a name, was a spur of rock projecting into the channel where now is deep water. The engineers of the Wear, with its narrow limestone bed, have had a more difficult task.

On the whole, the Tyne has kept pace with the growth of modern shipping. It has also reaped an advantage from the peculiar structure of its mouth. The fact that it has no broad estuary, but runs between the steep banks of Tynemouth and Shields, has been turned to account. The entrance looks rather mean and small for a great commercial highway; but the walls, running out to the 5-fathom line, control the shifting sands, so that a vessel enters straight from the deep sea into what is practically a dock. We may realize the value of this direct entry by comparison with the approach to the Tees, the Humber, or the Thames.

But the narrowness of this outlet and its steep sides have another aspect; the level space favourable for economic development is somewhat restricted. The river-front at Tynemouth and Shields is narrow, and difficult of access from the land side; there is little room for expansion except vertically. So the activity of the port is concentrated a little higher up. On the south side Tyne Dock is reclaimed from the levels of Jarrow Slake; on the north Albert Edward Dock makes use of the valley of a small beck; while Northumberland Dock is merely an enclosed bend of the river itself. West of the dock areas we have Jarrow, Hebburn and Wallsend spreading over the lower slopes and valleys, and behind them we come suddenly on green fields. At spots within sight of Newcastle these fields come right down to the river-bank, with here and there a shipbuilding yard or factory wedged into a corner between the river and the hill. The population adjusts itself to these conditions. The works must be on the river for the advantage of cheap and easy transport for their heavy products and materials; but the workers are not so tied, and we see row after row of their houses mounting gradually towards the hill top. This arrangement strikes the south-country eye as curious and unusual. Where more space is needed than the narrow banks afford, the modern engineer is cutting down the slopes wholesale to the water level, in spite of the cost of the process. At Newcastle itself we may look down from the high-level bridge on a line of busy quays; but the goods which are being landed there must all be hauled up by cart or underground railway to the level on which we stand. Above Bridges, on the north bank, we find the same arrangement; the works on the narrow river-ledge, the homes of the workers on the steep slope behind. But the wide marshy flats on the opposite bank are for the most part still untenanted. It is not all lowland which is favourable to human occupation.

The broad result of the structure of the Tyneside area is a curious

want of continuity in the population. The mining population, which is the basis of the river economically, is distributed in scattered blocks in the hill country. The industrial population is highly concentrated in the various towns on the banks, leaving districts in between with a very small density. The people work, and to a large extent live, in a narrow

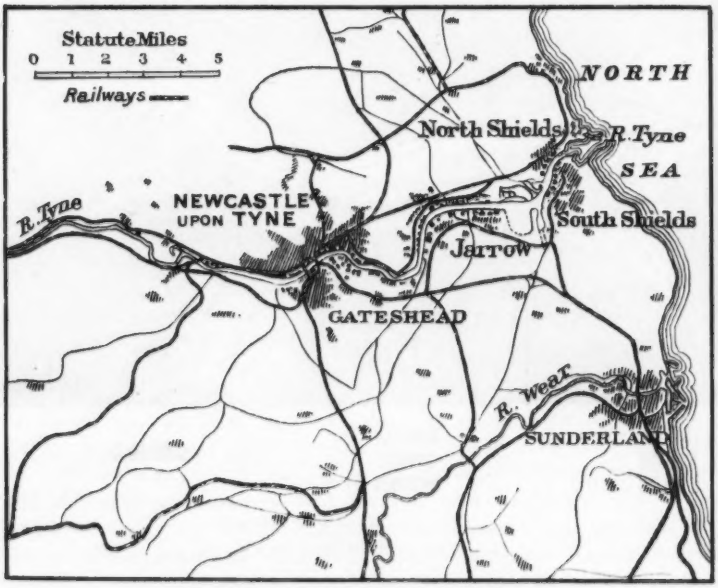


RIVER TYNE AT NEWCASTLE.

belt, with the river on one side and the railway on the other; this is the effective Tyneside.

A threefold railway system is necessary for the existence of this area. First there is the group of mineral lines engaged in the movement of coal; these may be independent or may act as feeders to the larger collecting railway. These waggonways, with their trucks running up and down by no visible agency, are to be met with everywhere. Then we have the riverside lines, running at a level of from 50 to 100 feet, and in places actually on terraces cut along the steep bank. Between these lines and the river is gathered most of the economic activity which they

promote. Where they unite, at the bridge above Wylam, the real Tyne may be said to end. Behind and above the riverside lines come the main passenger lines, of which the most important run north and south. Here the structure of the country is utilized to avoid the disadvantage of the great drop of the banks between Newcastle and Gateshead. The railways avoid the lowlands and valleys, and keep along the flanks of the highground, and so cross the gorge of the Tyne by lofty viaducts. When we leave Durham we have the heights of Newcastle in view, so we avoid the valley bottoms of the Wear and Team. The Roman road does the same thing at a still higher level; but at Gateshead it must plunge down



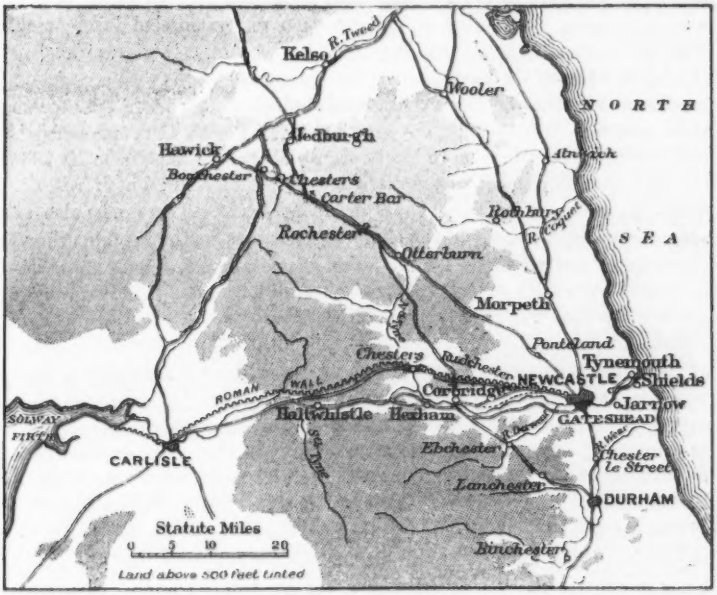
DISTRIBUTION OF POPULATION AND INDUSTRIES.

to the river level to reach the old bridge. The influence of physical features on railway routes is thus modified considerably by the special conditions found at the crossing point of the river.

The railway which carries the traffic to Carlisle and the iron districts of Cumberland at last gives its full value to the Tyne gap. So that some eighteen centuries have been needed for the evolution of this particular geographical influence, though it was suggested in the proposal for a canal early in the nineteenth century.

Coal may be the ultimate basis of the activity of the Tyne, but only a small proportion of Tynesiders are engaged in the actual handling of coal. To the carriage of coal by sea in early times was largely due the

rise of the shipbuilding industry on the Wear and Tyne. Then came the age of iron and steam, and the Tyne produced the first steam collier for the coasting trade to London. From this beginning has grown the great shipbuilding industry of to-day, with all the minor related industries which crowd the banks of the river. Coal, labour, and highly organized transport by sea and land, are here in abundance, but the raw material is lacking and must be imported from further south or from abroad. So the utilization of its natural resources to the full has necessarily involved the Tyne in wider relationships. Ores from the Tees, from Spain, the Mediterranean, Scandinavia and Chile are landed on its banks, and leave



STRATEGIC ROAD MAP.

them again as ships or machinery. With one notable exception, for which the conditions of coal-transport are partly responsible, the work is carried on within sight of the river.

Even the original getting of the coal has led to a vast trade in heavy material, since the whole of the pit props must come from abroad, largely from Scandinavia and the Baltic. So we have a natural balance in the movement of heavy materials, based on geographical conditions; coal and iron goods moving outwards, timber and ores inwards. Here is one important factor in the traffic of shipping between the Tyne and the neighbouring Continent. The local hinterland of the Tyne thus only receives its full geographical meaning as part of a much larger area,

connected, not divided, by the sea. The area of these external relations is extending. South America, among other countries, needs coal, and has bulky foodstuffs to export; and there has been a remarkable growth in imports of foodstuffs into the Tyne of recent years. Much comes from the Continent, but more and more is coming from distant regions. This alters the value of the geographical conditions of the river, since it must be judged in relation to the needs of the larger vessels engaged in the long trades. A modern commercial seaport is made, not born, and must rise superior to mere physical conditions if it is to hold its place in the contest for supremacy. So we come back to coal as determining the nature of the work of the Tynesider, his needs and his purchasing power, and influencing largely the actual direction of his foreign intercourse. But the connection with coal may tend to become rather less direct in the future than in the past.

Many industries on the Tyne have found electricity more adapted to their purposes than steam. The growing use of Power, thus transmitted, will produce a modification in local geographical conditions, in so far as it involves a smaller local distributive movement of coal; but it will not affect the great bulk of the export or inland trade. There may also be some slight improvement in the climatic conditions in the neighbourhood of the river as a result of the reduction of the smoke. A far more important modification in the geographical relations of coal will be brought about in another way. A large quantity of coal is consumed, as near its source as possible, in coke-works and blast-furnaces, and in raising steam at the mines themselves. In all these processes there is a surplus of heat which is wasted into the air, and waste can no longer be ignored in view of the tendency of the cost of our coal to rise, through causes physical or economic. The waste represents a surplus, so that there may perhaps be no market for it locally; but, converted into electrical energy, it can be transmitted to any part of the area which lacks Power. The natural area of concentration for electric, no less than for steam Power would seem to be the banks of the Tyne. The problem is one for engineers, and is already being handled with success. But the change from steam to electricity will not seriously alter the geographical relationships of Tyneside, since it is merely the equivalent of more coal, or coal more economically employed. The main result is likely to be an increase in the density of the population of Tyneside, a filling up of the gaps in the populated area, and the progressive overcoming of minor physical difficulties. The process will still be controlled by topographical conditions, but the relation between the people and the land will become more and more difficult to trace with each modification of local conditions by deliberate human action.

Major DARWIN (before the paper): I am sorry to say that Lord Curzon is again indisposed.

Our lecturer to-night, Mr. Sargent, is Lecturer in Foreign Trade at the School

of Economics at the London University. In the course of his studies he naturally first attacked the question he had to deal with largely from the statistical side. But I think he soon discovered that it was necessary, in order to make this subject intelligible, to attack it also from a geographical standpoint. In the course of his investigations he worked in close harmony with Mr. Mackinder, more especially in endeavouring to introduce the newer methods of the instruction of geography. It is, I take it, as an illustration of these methods that he proposes to discuss one selected district in England, and I am sure we shall listen to him with great interest in his geographical description of Tyneside.

Prof. L. W. Lyde: I wish for your sakes that somebody who knew more about the area in question had been called on first. I have at various times, of course, had to go into the geography of the area. It seems to me, if I may venture to say so, that Mr. Sargent has given us a very admirable study in economic geography, and the value of the study is not in any way limited to the area with which he deals, because it seems to me a most excellent illustration of a double truth that needs to be rammed home in this country now. The first is that a proper study of geography is not an insane concentration on analyzing land forms, but a sane synthetic outlook on the relation of man to his environment. The second is that there is a time question in almost all of these geographical problems. You find the geographical control is permanent, but the manifestation of it varies with the control that man gets over nature. As to the particular area in question, Mr. Sargent emphasized a conscious response to the geographical control, and conscious response, especially on industrial lines, is always essentially a modern phenomenon; but the unconscious response, as seen in the historical geography, confirms exactly what he said. For the Tynesider was first and foremost a frontiersman. Wallsend was famous as the end of the great wall centuries before it gave its name to a piece of the coalfield, and Henry II.'s New Castle was the strongest castle probably in the whole of this country. So the Tynesider very early had acquired, and, in spite of all the physiologists, handed down characteristics typical of frontiersmen—alert, shrewd, independent, and yet adaptable, not afraid of taking responsibility, and not unwilling to back up words with deeds. Presently this frontiersman appears on the scene as controlling one of the staple industries of his age on the continent—the wool trade. Newcastle became one of the first wool markets of the country, and the Tynesider thus early got his finger on the pulse of Europe. Mr. Sargent said the Tyne stopped where the coal stopped. That once was quite the contrary. The land that fed this great wool market with its wool, and which still makes Northumberland, with its relatively high winter temperature, the premier county in this kingdom for the raising of sheep, is west of the coal. But while the Tynesider was handling the wool of his hinterland, he was himself more concerned with the foreground. He was essentially a fisherman engaged in England's greatest historic industry, and it seems to me that throws light on the almost ideal democracy you find in parts of Northumberland, based essentially in olden days on the equality of man with man in the jointly owned boat, and of man with woman in the common home from which the fisherman was absent so long and so often, and to which he came back so weary after his long night watches, that the woman had to take her full share of rule and responsibility. It is to this that I would trace the clean living and thrifty habits of these people who burr their *r*'s. Presently coal comes into importance, and Newcastle, exactly halfway between the extreme north and the extreme south of the North Sea coast, had such advantages for distribution by sea that the fisherman had a wider field than ever; again he was dealing with the most important product of his age, only this time he has got his finger on the pulse of the world—

not only of Europe. This descendant of the sheep-farmer and the fisherman (two grand occupations) is a coal-miner. He is brought away from the fresh air of lonely places on fell and moor and sea to the dirt and darkness of the mine, and again he acquired and handed on the occupational characteristics of a miner. Hard work, constant risk, and high pay developed his strenuous qualities, no doubt; but they bred self-esteem, and they made him love danger for danger's sake, *e.g.* in gambling. And yet the man was still level-headed. He had mental balance, and he had moral ballast. For centuries he had been a guardian of England's frontier, and had been dealing with all her greatest industries—the raising of wool, the conquest of the sea, and the production of power.

I must not trespass further on your time and courtesy, but I hope I have said enough to suggest that the historical geography of the area throws essential light on its economic geography—giving grounds for the success of these men when they had to deal with the coalfield—and that the economic and historical geography together account for that political stability which is so rare on a coalfield, and which has made this county (of which I am not a native) long ago a strategic bulwark of England, and in modern times an economic bulwark of England.

Mr. A. S. Esslemont: I have a natural hesitancy in passing remarks on such an admirable paper, but I might point out two ways which may serve to modify Mr. Sargent's conclusion that the change from steam to electricity will cause an increased density of population on immediate Tyneside. The strata of coking coal in Durham are in a sort of quadrant running roughly some 30 to 40 miles southwards, westwards, and then eastwards of Newcastle, and the stations where the North-Eastern Electric Power Companies are engaged in converting the waste gases derived from the manufacture of coke into a form of power suitable for transmission and commercial use are naturally situated immediately adjacent to the coke ovens whence this source of energy is derived. Now, the enormous development in recent years of electro-chemical, electrolytic, and electro-thermal processes has resulted in the users of such processes searching over England for places where the cheapest possible electric power may be obtained, because in such processes such vast quantities of electricity are used in proportion to the tonnage of material produced that freights, and even wages, are only a secondary consideration. Even the capital and losses incidental to transmitting electricity any considerable distance cannot be afforded. These works must go to the *source* of power. This in itself may have a certain depopulating effect on immediate Tyneside. A peculiarity also in the turning to public account of these waste gases by converting them into electric power is that there is available for public utility during the hours of night and over Sundays a much greater amount than during the ordinary working day. The gases are produced continuously, but the owner himself naturally takes advantage during ordinary working hours, for the purposes of his own business, of a considerable portion of the electric power rendered available. Unless then there is to be waste, a use must be found for the quantities of this valuable agent available at night and over Sundays.

There are a number of industries, both in existence and which might be created, in which it might be of service. To take one example, there are those industries in which the pulverizing into a fine powder of a bulky raw material forms a preliminary to the main preparation of the final product. It does not matter at what *time* the material is ground down to powder. There will be a tendency here again for such users to situate themselves at the *source* of power in order that they may, by the cheapness at which it is *there* available, compensate themselves for the higher rates of wages they will have to pay for night and Sunday work, while still increasing their profit.

These two causes, while I do not think they upset at all Mr. Sargent's main conclusions, may still have a tendency to keep constant the balance of industrial population.

Mr. W. Tetley Stephenson: In dealing with the lower Tyne, a matter of considerable moment is the fact that no small portion of the low-lying land, to which Mr. Sargent has called attention, is of entirely artificial construction. Jarrow Slake is merely a small portion of a much greater area which was of the same character. Coal at that time was wholly a main freight, and the ship came back with sand ballast. That sand ballast was tipped sometimes on the edges of the Tyne, sometimes into the river itself. This has accounted for some troubles in connection with commercial developments. For instance, in making a big dock at Hebburn, great difficulties were experienced owing to running sand. That sand was not there naturally—it was this tipped ballast.

Then Mr. Sargent has referred to the transport of that district. The district was an unusually bad one for roads. The clay in that area made the roads very bad, worse than in most parts of the country. For a considerable period attempts were made to adapt the vehicles to these bad roads. Wide wheels were experimented with in the effort to get a vehicle which would take a reasonable load, but in spite of that one finds the carts which used to carry 17 cwts., dropping down to carrying a small load of 13 or 14 cwts. The waggon ways were the solution finally adopted, the lie of the land being particularly suitable for working by gravity. In this connection it is worth recording that the working of the inclines, in which the loaded waggons haul the empty waggons up the incline, is still the cheapest coal-working there is. In the whole of that area, although it is 150 years old, it is still cheaper than any method of working that has been invented, and, as far as can be seen, it is likely to remain the most economical method of working in that area.

One other point I might mention, and that is that the coal industry accounted for the great development of the railways in that district in their earliest days. When London had only two railways, the Tyneside area had 10 per cent. of the mileage of the country, and every mile, with the exception of a portion of the line between Newcastle and Carlisle, owed its existence entirely to the effort to bring coal down to the river for transport. It was an effort to maintain a position which Newcastle and Tyneside had won in the early days when it had such a monopoly that it made London pay the price it chose for its coal.

Dr. J. F. Unstead: I can only speak from a broad point of view; I have no local knowledge of the area. I think Mr. Sargent's paper was what is quite needed, for it was an excellent example of the real meaning of geography. It dealt with three sets of facts, the geological facts, the topographical facts, and the economic facts. He related these in the way that neither the geologist, the topographer, nor the economist could do; this correlation needed some one who had a wider outlook than is obtained in any one of these branches of knowledge. It seems to me that we have here a perfectly clear case for the need of a geographical science, for surely this correlation is more than a mere putting together; relationships and interrelationships appear, and there is a unity that did not exist before—a new piece of knowledge. Mr. Sargent's paper was not only in itself a correlation of value in that sense, but it may prove in the future a foundation for an even more important correlation—a correlation between the physical conditions and the essential life of the people, for economic geography very often tends to deal with things rather than with people. It would be very useful if Mr. Sargent's synthesis could be extended so as to show how this extraordinary concentration of industry, and therefore of people, into a narrow strip has determined social problems; for example, the housing

problems attaching to a concentration of population, and the lack of suitable occupations for women following from the concentration of industrial activity into a few great iron and steel industries in addition to the mining. It is when geography has, I would suggest, *risen* to be social geography that we shall see its full value.

I do not know whether I gained a correct impression that between the various settlements on the banks of the Tyne there are strips of country still not utilized, while they are having to undertake engineering operations to get suitable land for works and factories in the town areas. I should be glad to know whether there is no low land at about the river-level between the town areas, or whether there is any other reason for this remarkably close congregation.

Then I would like to suggest to Prof. Lyde that the difficulties in the South Wales mining region as distinct from the Tyneside region may be in part due to physical causes. I think we may find another example of geographical correlation here. I believe South Wales differs from the eastern coalfields in having had a more complicated geological history. There has been much faulting and overthrusting in South Wales, and this has led to the coal-seams being more difficult to work, and presenting constant need for adjustments due to "abnormal places."

Mr. SARGENT: There is no concentration of resident population on the actual banks of the river. For certain things, like shipbuilding, where you must be on the waterway, and you do not require a very great space, it will pay you possibly to cut down and level the steep banks. It will not pay you to cut them down to build artisans' houses. The available water-front on the Tyne is getting smaller; they chose naturally the broader level patches and the more accessible places first, but now it is difficult to find an unoccupied corner for new yards or factories. For most of these it is vital to have direct communication with the sea, so they are cutting down the banks because there is no space left without cutting down. How far it is going I do not know. It depends on the pressure of population on the "canal." I suppose some day those banks will be fully occupied in spite of the steepness. I will not detain you longer, because my critics have not attacked me; they have really on the whole suggested the very things I should have liked to deal with if I had had ten hours in which to do it.

THE PIBOR RIVER.

I. THE UPPER SOURCES.

By Captain H. D. PEARSON, R.E., Director of Surveys in the Sudan.

IN his interesting article on "The Problems in Exploration—Africa," which appeared in the November number of the *Geographical Journal*, Mr. Frank Cana refers to the tract of country lying to the south of the Sobat river and east of the Bahr-el-Jebel.

This region receives on the south the streams which flow from the foothills of the equatorial plateau, and is drained by the Pibor river and its tributaries. Large tracts are flooded during the rainy season, while in

the dry months of the year water is, in many places, scarce. The tribes inhabiting the region are mainly pastoral in character.

The Beir tribe, who graze their cattle along the main branch of the Pibor river, have from time to time raided the peaceful Dinkas living on their western boundary at a distance of one or two days east of the Bahr-el-Jebel. These raids have often been attended by great brutality, and eventually resulted in a punitive expedition being recently organized to act against them, which has afforded an excellent opportunity for exploring their country. It was arranged that one column should proceed by steamer as far as possible up the Pibor river, and should then march south; a second column was to advance eastwards from Bor, on the Bahr-el-Jebel, while a third, the southern column, was ordered to proceed to Jebel Lafon from Mongalla, and to endeavour to find the main source of the Pibor river and trace its course from the foothills of the plateau on the south down to the point where the three columns were to concentrate, the village of Sheikh Lom, who was said to be the responsible chief of the tribe. The date of concentration was fixed for January 18, due allowance being made for delays in the rate of the progress of the different columns on account of the exceptionally dry character of the preceding months.

Provided the expedition was so far successful, the further exploration of the country lying to the eastward towards the Boma plateau and Tirma was contemplated.

The results of the expedition from a survey point of view are, I fear, very meagre, and there is still some doubt as to the main source of the Pibor river, but the following account of the movements of the southern column and the country which it passed through may prove of some interest.

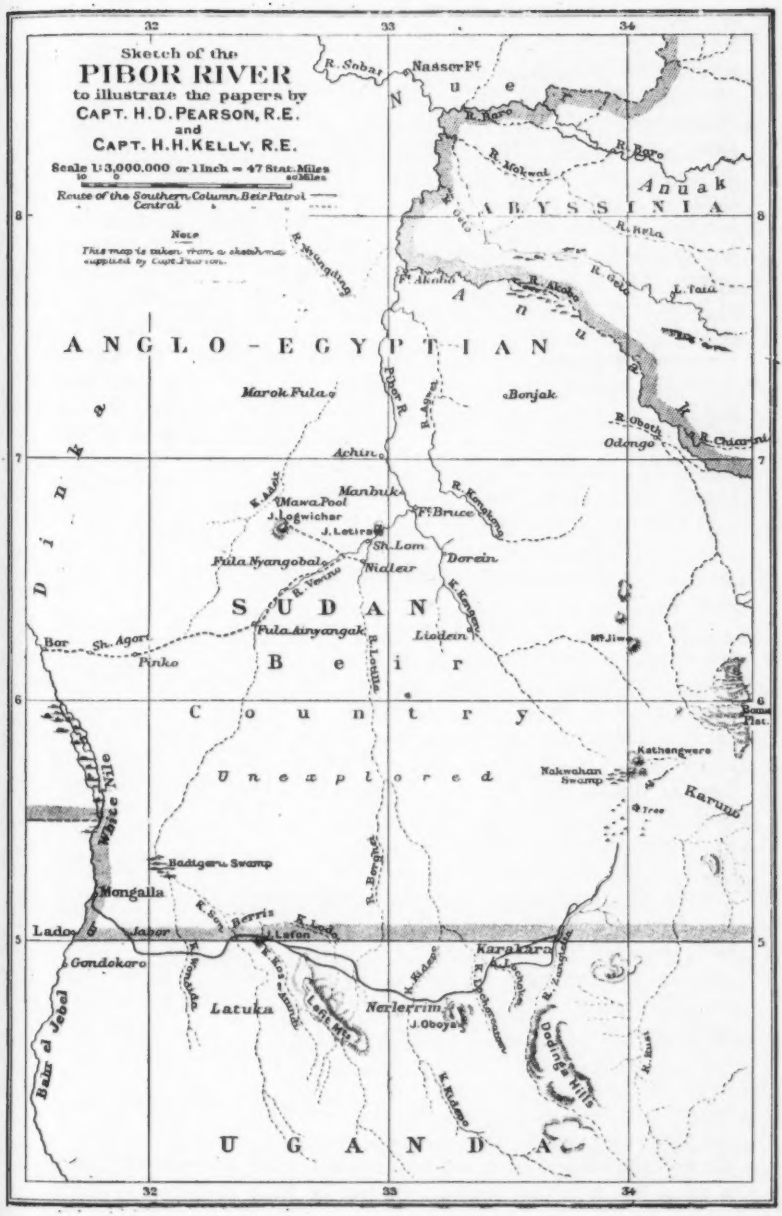
On December 29, 1911, I started from Mongalla, together with Captain R. C. R. Owen, C.M.G., the Governor of the Province, who was accompanying the patrol as political officer; we marched to Lafon, where we arrived on the morning of January 2, 1912. Jebel Lafon is a small isolated hill, some two miles in circumference, rising about 560 feet above the plain; it is densely populated by the Berris, who originally came from that section of the Anuak tribe which inhabits the upper waters of the Akobo river. They possess much cultivation, many goats and sheep and a few cattle. They appeared not unfriendly, more ready to receive than to give, and eager to be treated by the doctor who accompanied Captain Owen. On January 4, Captain Elgee, who was in command of the mounted infantry section of the column, returned from a reconnaissance and reported that the first two khors met with to the eastward, the Lodot and Borghei, both contained water in pools. As far as he could judge, Khor Lodot probably turned westwards and drained into the big Badigeru swamp, as do most of the khors between Jebel Lafon and the Bahr-el-Jebel. He believed, however, that Khor Borghei was certainly one of the sources of the Pibor river. This tallied with all the information we had previously been able

to collect, and we only awaited the arrival of the main column to march to the Borghei and down that khor to Lom's.

Numerous hills to the southward are visible from Jebel Lafon, and 15 miles off, in a south-easterly direction, the magnificent Lafit range is the most conspicuous feature. This range extends from north-west to south-east over a length of 33 miles, and its peaks rise to heights of over 6000 feet above sea-level. It is said to be populated on its north-eastern face throughout its length, and some trade with the Beirs is carried on in spear-heads, so that iron doubtless occurs in this range. Marble, very prettily grained, was also seen in small quantities. Some 60 miles off, and beyond the Lafit range, the striking peaks of the Oboya hills were clearly visible, resembling in their rugged outline nothing so much as the horns of a rhinoceros.

On January 5, the column under Captain Arden arrived, and our compact little force, which was now complete, consisted of 25 men of the mounted infantry from the Arab battalion, and 120 men of the 14th Sudanese battalion. Two days later the column moved off and arrived at Khor Lodot after a trying night march, the latter part of which was through high unburnt grass. On the next morning a short march again through high grass brought us to Khor Borghei. One look at the Borghei was sufficient for our guides, who informed us that the little water in the khor would never suffice to take us to the Beir country, but that we must go further east to one of the other khors which go to form the main Pibor river. It is probable that their view was correct, as we heard later that the Bor column found the main river dry at two days' march south of Lom's; but at this time of year a fortnight makes a great deal of difference in the amount of water which may be found standing in the pools, and it might have been well to have made further investigation. Acting, however, on the advice given us, we moved a short way up Khor Borghei, and then made a long night march, on which we were much delayed by a stampede of the donkey transport; this brought us to the Kidepo, which was a fine deep khor, but which, alas! showed no sign of water. We had been making straight for the Oboya hills, and the guides, who had apparently not expected to find water in the Khor Kidepo, led us on till they reached a rock under the west side of the nearest and most northerly hill of the group. A dried-up pool was all that was visible, and Captain Owen was beginning to be anxious until the inhabitants of the hill appeared, proving that water could not be very far off.

The suspicions of these natives, the Nerlerrim, who were more or less in warlike array, were speedily overcome, and the whole column was soon quartered beside water-holes in the shadiest and most comfortable camp we had yet had. These Nerlerrim are a section of the Beirs, and speak their language. Apparently they never leave their hill for fear of their neighbours and enemies, the Karakara, and in hopes no doubt that we might have something to say to the latter, they were pleased to look kindly


Sketch of the
PIBOR RIVER
to illustrate the papers by
CAPT. H. D. PEARSON, R.E.
and
CAPT. H. H. KELLY, R.E.
Scale 1:3,000,000 or 1 inch = 47 Stat. Miles
Route of the Southern Column, Beir Patrol, Central
Note
This map is taken from a sketch-map supplied by Capt. Pearson.
32
33
34
R. Sobat
Nasser Pt
N u e r
R. Baro
R. Boro
R. Mokwai
Anuak
ABYSSINIA
R. Gelo
R. Kela
R. Nyanding
Pt Akobo
R. Akobo
R. Gelo
L. Tata
A n u a k
ANGLO-EGYPTIAN
Marok Pula
Pibor R.
R. Agwa
Bonjak
R. Obeth
Odongo
R. Chiarini
Achin
Manbuk
R. Kenkeng
Mawa Pool
J. Logwichar
Pt Bruce
J. Letira
Sh. Lom
Pula Nyangobal
Nidier
Dorein
R. Ventiu
R. Kengeng
S U D A N
Pula Anyangak
Liodein
Mt Jiwa
Bor
Sh. Agor
Pinko
B e i r
C o u n t r y
Bonga Dist.
Kathengwere
U n e x p l o r e d
Nakwahan Swamp
Tree
Rarunga
White Nile
Badigeru Swamp
R. Bergnit
Mongalla
Lado
Jabor
R. Sobat
Borris
R. Lotilla
J. Lefon
Karakora
Gondokoro
R. Kidepo
R. Dongolomum
R. Zangalda
Latuka
Nerlerrim
J. Oboyan
Bahr el Jebel
Lafit Mts
Dodinga Hills
R. Kidepo
U G A N D A
32
33
34

on our expedition and to pass us on still further to the east. They and the Karakara, whom we met two days later, both wear a narrow skin girdle loosely laced in front, an attempt at clothing which is not in fashion among the tribes living nearer to the Bahr-el-Jebel. Their arms consisted of long-handled spears and short stabbing spears neatly sheathed in peace time, and they all carried oblong shields of hide, which were usually decorated with a rosette of feathers. Many wore a circular knife in the form of a bracelet about the size of a saucer, also neatly sheathed, while a few had a leather armlet, decorated with cowrie shells, and from which hung a giraffe's tail. Their head-dress varied considerably, some favouring ostrich feathers to an extent that would be envied at home in these days of large hats, while others were content with bead rosettes worn at the side of the head; others, again, more simple in their tastes, merely wore the usual cup-shaped covering of plaited hair and grease. The Karakara follow the inconvenient fashion of wearing iron rings round arms, ankle, and neck to a ridiculous extent. The custom was not universal, but some of the older men had their arms completely covered from elbow to wrist, while their necks were permanently stretched by a dozen or more of these uncomfortable ornaments. Hopes had been held out to us of meeting with a river of running water, and as far as could be gathered from the very imperfect interpreters who were with the column, these Nerlerrim were quite willing to assure us of running water ahead, since it obviously pleased us to hear of it.

The next day therefore a further move east was made and another considerable watercourse crossed, which, however, was quite dry; and a little before midday we struck the sandy bed of a khor, apparently the Lochoreatom of Major Darley's account. In it water just sufficient for our immediate needs was obtainable by digging, but our spirits were raised by the capture of a Karakara, who, with his wife, had unsuspectingly come down to drink. The lady was decorated with beads, given presents of cloth, and sent on to give warning of our approach to Chief Tuliobong, while her husband remained to act as guide.

So far the country traversed had been one vast plain, covered occasionally with grass alone, occasionally with scrub, and in parts bearing thin forest which became slightly thicker in the neighbourhood of the hills; here and there, particularly west of Jebel Lafon, a small outcrop of ironstone was met with, but most of our route lay over "black cotton" soil. The country naturally rose slightly towards the hills, but even when approaching the khors the depression was so slight as to be hardly noticeable. Lines of trees were most misleading and formed no guarantee that water, or even any trace of a watercourse, existed. The mean value deduced from the readings of the three aneroids carried by the column showed a rise of no more than 90 feet above Mongalla (1406 feet above sea-level) by the time the furthest camp had been reached, which lay some 150 miles in a direct line from that station. On leaving Khor Lochoreatom and for

two days afterwards, however, the country was distinctly undulating, with well-marked valleys, and ridges capped with loose stones. On mounting one of these ridges, 5 miles from our camp, we were not surprised to see the Karakara spread out in parties about 100 strong along our front, for we had quite expected that the column would have trouble from this section of the Beir tribe. Captain Owen advanced alone, and through our field glasses it was most interesting to follow his progress, the British and Egyptian flags appearing from time to time above the long grass, as he descended the valley and mounted the opposite ridge. The more suspicious among the Karakara fled, but Captain Owen succeeded in reassuring some adventurous spirits among them, and the column was shortly afterwards personally conducted to the august presence of their portly chief. Their river was again a disappointment, but ample water was forthcoming from many wells which had been dug to a depth of some 30 feet.

Next morning a march of 5 miles due east brought us to the main watering-place of their cattle. The sandy river-bed, called indiscriminately Khor Lochokei and Khor Lokolowen, was here no less than 120 yards wide, with banks 8 to 10 feet high, which was an extraordinary change from the insignificant depression we had left at the village of Tuliobong, making it difficult to believe we had not struck an entirely new water-course. Their cattle were very numerous, and they explained to us that they would rather we did not go too near, as the temptation to take the cattle might prove too strong for us. We were, however, allowed to water our animals from other wells. Tuliobong had been good enough to come as far as this with us, and sat dumbly by Captain Owen while one of the older men shouted objections and imprecations as he approached. He continued, in great wrath apparently, to hurl abuse at us in the governor's presence, and it eventually transpired that he had the strongest aversion to our being allowed to water at all, and was urging Tuliobong to turn us all out. Tuliobong sat perfectly passive throughout the harangue; indeed, throughout our acquaintance with him he seemed a man of few words. It was a relief, therefore, when Captain Owen adopted a very stern tone, upon which the truculent gentleman disappeared into the background and our relations with all around us seemed to improve.

The Karakara, a rich and powerful tribe, cultivate durrha and ground nuts to a considerable extent; they possess large herds of cattle, as well as numerous donkeys, which presumably came originally from Abyssinia. The donkeys, who apparently have never been worked, are small but sturdy-looking little beasts of a uniform mouse-colour, and are marked with a striking black band over the withers. The mode of greeting in vogue among these people was more peculiar than pleasing, the custom being to take a handful of earth, to spit on it, and then to throw it over you. It is presumably intended to signify that their land is your land.

A good afternoon's march, during which a number of small hills directly in our front became visible, ended in a camp on an excellent ridge, the first satisfactory observation post I had had since the patrol left Jebel Lafon. Two giraffe had been sighted just before reaching camp, and as we were in great need of meat, a couple of soldiers were despatched in pursuit. A number of Grant's gazelle and some cattle which we had seen on the excellent grazing through which we had come, all served to raise our spirits, and we really thought that at last our water troubles were about to end. The giraffe hunt proved unsuccessful, and when I had completed my observations I learnt that the first regrettable incident had occurred, viz. the untimely death of two apparently perfectly healthy members of the company of grazing cattle. We had hoped by this time to have reached the country of the Beirs, where we should have had no compunction in helping ourselves from their herds, and we had also counted to a large extent on being able to live on what we shot, but the absence of water meant of course absence of game, and both men and carriers were already beginning to feel the effects of short rations.

A march of an hour and a half brought us in sight of the finest trees we had yet seen, and we almost ran down to the Zangietta, the river which they concealed. We had already in our hearts, I think, begun to doubt the existence of a river of running water anywhere, much less in these parts, so it was all the more acceptable to find not only a veritable river-bed, 120 yards wide, but in it ample water standing in shallow wells. We felt we had reached the first of our goals and gave ourselves up to a day's enjoyment, the men revelling in washing their bodies and their clothes. A friendly sheikh made his appearance, and we succeeded in explaining satisfactorily the cause of the accident to the cattle and offering suitable compensation to the owner. As usual the doctor's camp was in great request by many of the tribe, but we could not delay, and accompanied by the sheikh and his ailing wives, who desired further treatment, we departed next morning towards the north.

After a march of 12 miles we stopped in the bed of the river under the shade of some delightful trees in order to water our animals, and from a neighbouring hill we were able to see the lie of much of the country. We had in the course of that morning, after many days' wandering in Uganda, re-crossed the Uganda-Sudan boundary and made our first real advance in the direction of Sheikh Lom's. A hill, which the natives called Negiei, had come into sight in the far distance just to the east of due north, but I did not immediately associate it with Major Austen's Kissingore or Kathengwere. Still we remained optimistic in the extreme, and were only too ready to believe that we should follow the khor on which we now were, until we reached a big river under Jebel Negiei, and that this big river was the river of the Beirs.

It was now January 16, and the Beirs' stronghold was not to be attacked till the 18th, so that two days still remained. I guessed the hill (it was a

wretched guess, I am ashamed to say) at 30 miles off, so that we could reach it in two days, and if, as we expected, the Beirs were driven upstream, our column would yet be the chief factor in the success of the Beir expedition. We had, however, to get food, and as a big village was visible an hour or so ahead, we decided to make it before nightfall. After a thirsty march on the next day we were led to a smaller khor, which, however, held sufficient water in shallow wells and pools. The following morning we crossed and re-crossed this khor three times before arriving at a very meagre supply some 10 miles further to the northward. But Jebel Negiei seemed to get no nearer, and I had by this time grasped the fact that it must be the Kissingore of Major Austin's account, and the promised river the "Kuroni."

Friday, January 19, was the first day that we realized the possibility of failure. We had gone some 5 miles in the direction of the hill, when the guide sat down and said there was no water ahead. The going through long grass had been very trying, and it took very little time to decide that we must go back at once to the water we knew of if we were to save our gasping carriers and weary animals, which had had but a poor drink the day before.

My observations from the top of the hill, by which we had watered two days before, showed that the big khor that we had left ran in a north-easterly direction, so mounted infantry were at once sent to explore in this direction, but they returned by nightfall with the news that they had found three little khors only, none of which contained water. While we were still discussing what was to be done, Captain Arden's enterprising orderly, Samit, returned to camp and reported that he had been burning grass miles in advance of the position from which we had retraced our steps, and had seen fresh elephant tracks, animals which we concluded must be oryx, and, most cheering of all, zebra; but I am afraid that Samit is the owner of a dangerously vivid imagination. My calculations showed that we could not be more than 20 miles from the position in which Major Austin had sketched in the Kuroni river and only about 35 from where he had actually camped and found water in March, 1901. It was therefore decided that Captain Elgee with some mounted infantry should make a dash for the water, which we confidently expected would be found at no impossible distance ahead. The column, meanwhile, would proceed some 10 miles on the way and then camp for the night, so as to reduce the length of the march on the following day; in the event of failure, it would still be possible to return to the present water. Captain Elgee very kindly offered me a mount on a spare mule and we started a quarter of an hour before sunrise, fixed the place for the column to camp, and pushed on, our hopes being raised, firstly by some of the men seeing a lion, and secondly by the sight of thick bush at the end of the grass plain on the horizon.

A beautifully clear day made Negiei or Kissingore hill look enticingly close, and though the going was not good it was not until we were well

inside the thick "kittir" bush that we had any doubt as to our success. Mounted as we were, progress through these thorns was miserably slow, and at noon we decided to halt and send men ahead on foot who would return and report in an hour's time what they had seen, while we had something to eat. At one we saddled up again, and shortly afterwards the men returned with the news that the "kittir" bush continued far to the northward. We could only allow ourselves to delay until 3 p.m. before turning back, as the mules could not go more than one whole day without water. We decided to strike in a north-easterly direction since that was the direction in which Major Austin had met the Kuroni river, and Captain Elgee and I hurried on on foot, dodging under the thorn trees and leaving the mules to follow behind. Three-quarters of an hour later we were clear of the bush and stumbled on a couple of fine oryx. Rows of trees were visible to the north and to the east, but both directions could not be explored in the time which remained to us, and as game tracks were seen coming from the east we made for that direction almost at the run. The north-easterly line of trees proved as deceptive as we had previously found other lines of trees to be, but in the far distance a single tree at the top of a ridge seemed likely to command a fair extent of country. Exactly at 3 p.m. I reached the tree, and a more dreary outlook than that which appeared from its branches I have never seen. The line of trees to the north, which we had rejected, disappeared into a hollow to the east; to the east there stretched an endless grass plain, and neither game nor cattle nor human habitation were visible in any direction excepting for three or four oryx, animals which are very independent of water.

We were already some 26 miles from our last watering-place and there was certainly none for another 5 miles, or it might quite easily be 10 or 15, and for our already failing carriers such a distance was out of the question. We were therefore reluctantly compelled to acknowledge defeat, and turned back, a very silent party, to announce our failure. We did not succeed in reaching camp that night, and our absence caused Captain Elgee great anxiety, but to our great relief we found his camp still at the advanced position that we had fixed for it, and a cup of tea and breakfast were never more welcome. There was now nothing for it but to return disconsolately to our last watering-place, where men and animals were given a much-needed rest, since all further hope of success had to be abandoned.

The return journey as far as Jebel Lafon was uneventful. I was able to check my survey and fix the position of one or two hills, which the exigencies of the military expedition had prevented me from doing before, and I also had the good fortune to spend an excellent morning on the top of the northernmost of the Oboya hills. A clear day, and a native refreshingly ready to impart information, enabled me to trace what I believe to be the course of many of the khors which unite to form the Pibor river. It is most disappointing that I am unable to speak positively on the

subject after so much marching, and the only useful work I can lay claim to is that I have fixed with comparative accuracy the position of a number of hills whose names I do not know, and that certain khors, nearly all of them dry in January, 1912, were crossed at certain places.

Commencing from the Bahr-el-Jebel at Mongalla, the first considerable khor is met with at a mile and a half from the Bari village of Jabor. This khor apparently drains a small area of country up to 15 miles from the Bahr-el-Jebel, and in the rains it discharges into that river opposite Jebel Lado. During the rest of the year, water is to be found in its bed by digging. The Khor Faleru, 7 miles further on, is more of the nature of a "fula" or tank, and I think it is doubtful if water ever actually flows in it. On the return journey, water was some 2½ feet deep at the point at which we crossed it, but 3 miles to the north there was nothing but a wide swamp, which was quite dry in this month (February, 1912). Fourteen miles eastward from the Faleru, the Khor Wondida drains to the northward; it was dry at the end of December, 1911, and no water was found at the bottom of wells which had been sunk in its bed to a depth of 30 feet. I crossed it both coming and going at night, and, though I could not explore it, I am probably correct in supposing that it is one of the watercourses which help to form the Badigeru swamp which lies some 25 miles to the north-east of Mongalla. Nineteen miles further on is the Khor Son, which is said to hold water all the year round. I had hoped at least to be able to investigate this watercourse before returning to Mongalla, but this was impracticable, for only an inch or two of an almost undrinkable fluid could be obtained even by scraping at the bottom of its sand-covered bed, and the desertion of all but three of my carriers effectually put a stop to exploration. Kharafalla Eff., an officer of the mounted infantry which accompanied the column, followed the khor for some 10 miles northward and found that it here spread out into a large pool, and there was some indication that the line of drainage then took a westerly direction. The Khor Kos or Atundi, the source of water supply of Jebel Lafon, also takes a westerly course, and probably joins Khor Son somewhere in the neighbourhood of the parallel 5° 15′ N. There is yet one more khor, the Lodot, which, as seen through field-glasses from a spur of Jebel Lafit, seems to flow west for a considerable distance. The natives of Jebel Lafit say that it turns round to join Khor Kos quite near Jebel Lafon, and certainly a mile or two north of this hill we met with a well-defined khor whose course I could not explain, so that it seems highly probable that this khor was actually the Lodot. It is probable, therefore, that these khors, the Wondida, the Son, the Kos or Atundi, and the Lodot, are the four main feeders of the Badigeru swamp, and there also seems little doubt that the Badigeru swamp, when it is full in the rainy season, discharges itself into a channel which further north is known as the Vevino and is the Pibor river of Captain Comyn.

Continuing eastward, the Khor Borghei, which is joined by the Khor

Dira about latitude 4° 50′ N., had a clay-covered bed 40 feet wide at the point at which we met it. The banks were some 8 feet high, and its course, as seen from the branches of a tree, was a little to the east of true north. Beyond this lay the Khor Kidepo, which is a fine deep khor 30 feet wide, with banks 10 feet high, which rises some 20 miles further eastward in the range to the east of Lafit, as far as could be seen, and in the immediate neighbourhood of the point where we crossed it its course was towards the north-east. It is doubtful if the next khor, that from which the Nerlerrim obtained their water, ever reaches the main Pibor river, for it was a mere sandy depression where we met with it and a mile to the north there was little but a dried-up swamp by which it could be identified. According to my friend on Jebel Oboya the next two khors, the Kalinurenei and Lochoreatom, after their junction a short distance to the northward of our camping place, flow in a northerly direction until they are met by the Khor Lochokei at no great distance from Tuliobong's. Later on these khors were joined by the Kidepo to form a branch of the main river on which the Beir tribe lived. My informant said, however, that the Khor Borghei or Burkei was the best and most usual route to the Beir country.

The only other river met with, the Zangietta, is difficult to understand. As already described, it is a most imposing river-bed in the region where we met it, but after running for some 50 miles approximately from south to north, it seems to spread itself out fanwise, into a number of insignificant watercourses which gradually disappear, and it seems doubtful if any water from it ever reaches the Kuroni river of Austin, Darley, and others.

The Karakara knew of no other river lying further to the eastward, but Major Darley has crossed a khor which he calls the Lotilleit, and which probably drains the eastern side of the almost continuous hill range which we could see from our most northerly camps lying to the south-east. Whether this khor joins the Kuroni river or not I cannot say, but it is certain that the course of the latter westward of the point where Major Austin met it, is considerably to the north of the position indicated on his map.

Water difficulties also interfered with the movements of the northern and central columns, but Captain Kelly, R.E., and Mr. Boyce, who accompanied these columns, have established the fact that there are three main southern branches of the Pibor river, called by them the Vevino, the Lotilla, and the Kengen, and these branches have been followed, so far as their courses are shown, by continuous lines on the map. There remains a strip of unexplored country which is about 100 miles broad, and I hope it may be found possible in the near future to make a further expedition for the purpose of completing our knowledge of this part. In the mean time I have sketched in dotted lines what I think may probably be the course of the rivers through this unexplored belt.

It is interesting to note that all the khors which were met with by the southern column had quite steep high banks, while the rivers which the other column encountered had, on the contrary, wide and gently sloping beds. Presumably the level of the surrounding plain is gradually reached, and it is not till some distance north of the route followed by us that any considerable area is flooded during the rainy season. It is to be regretted that the information we were able to collect about the tribes met with is as meagre as our contribution to the geography of the country, but we were much handicapped by the impossibility of obtaining reliable interpreters, and by want of time, for the column covered 400 miles in forty days, which included a halt of four days at Jebel Lafon. One point which struck us as peculiar was the absence of any burial-grounds. We were told that it is the custom to break the legs of the dead and to bury the body in a sitting posture, leaving no sign of the grave above ground.

The southern column of the Beir patrol at any rate would be the last to dispute Mr. Cana's inference that this unknown region was probably "an undulating plain, a swamp in the rains, and thirsty land at other times of the year, supporting a considerable population of unsophisticated negroids."

II. THE BEIR COUNTRY.*

By Captain H. H. KELLY, R.E.

As a supplement to Captain Pearson's account of the survey work which was carried out by him with the southern column of the Beir patrol, some information regarding the Beir country itself may be of interest.

Mr. A. A. R. Boyce, of the Sudan Survey Department, was attached for survey duties to the northern column under Captain F. Dickinson, which ascended the Pibor river by steamer to a point above the Akobo junction and thence followed up the first-named river by land. I was attached for the same purpose to the central or headquarter column under Major Drake, which struck in from Bor on the Bahr-el-Jebel or upper Nile. As survey operations were limited practically to the routes followed by the two columns before and after the concentration, the results are necessarily somewhat meagre, and a considerable gap of unexplored country still exists between the sources of the various rivers which were seen by Captain Pearson and their lower reaches which were visited by these two columns.

The central column, striking eastward from Bor, met after some 70 miles the Khor Vevino, which was the waterway followed by Captain Comyn in September, 1904,† after leaving the Pibor proper. This khor was met with at the pools of Ainyangak, probably close to the highest point reached

* An account of the exploration work carried out by the northern and central columns, Beir Patrol, January—March, 1912.

† *Geographical Journal*, vol. **31**, p. 304.

by Captain Comyn in his steamer, and it is an interesting illustration of the manner in which the whole face of the country is changed during the rains, that when seen by the patrol the course of the khor near this point was only distinguishable by the slightly greener appearance of the grass. As the junction with the Lotilla was approached, the course of the Vevino became more marked, till at Nyangobal, where it leaves the open grass plains and enters a belt of bush a mile wide, it assumed the aspect of a river, though everywhere the pools were rapidly drying up in January. The assumption that the Vevino connects during the rains with the Badigeru swamp is no doubt correct, but it is also evident that the greater part of the tract lying between the meridian of Pinko and that of Nyangobal is equally under water during that season. The Khor Adeit, which was visited at a later stage of expedition, is as typical a feature of the country as is the Vevino upstream of Nyangobal. During the dry season its course meanders through a grass plain, and, like the Vevino, is as a rule only distinguishable by the greener appearance of the grass and by occasional pools. These characteristics apply equally, so far as is known, to the greater part of the country northward as far as the Sobat river, a tract affording dry-season grazing ground for vast herds of cattle, which, during the rains, are collected at the permanent villages situated on higher ground.

The northern column, having encountered no difficulty in its march up the Pibor, effected its concentration with the central column as arranged near the junction of the Vevino with the Lotilla. Reconnaissance for some 35 miles to the south of this point failed to solve the problem whether the latter river or the Kengen which joins it some 25 miles north of the Vevino junction, is actually the head stream of the river named Pibor by the Nuers and Liloth by the Beirs. Native information indicated that the Lotilla in the month of January contains no pools south of a point of which the approximate latitude is 6° 10′ N., whilst the report that at the beginning and end of the rains people from the hills to the south follow down the river bringing spearheads and iron for barter, points to the likelihood of the Lotilla being fed directly by the Khor Borghei which was crossed by Captain Pearson to the east of the Lafit hills.

The Kengen at the end of January had, at its junction with the Lotilla, a surface flow of about 3 cubic feet per second, but a month later it was absolutely dry there. Its course was followed to a point some 70 miles up-stream of the junction, and it was at the end of January, for almost the whole distance, a water-logged grass bed varying in its width between 50 and 100 feet; by native report, the river was dry at that time of the year above the furthest point reached. On either side of the channel, the banks of which were hardly perceptible, there was thick bush for about 300 yards in average width, where the flood marks indicated a probable flood depth of water in the channel of 15 to 20 feet. Native information reported that the river flows from the southward of Jebel Jiwe (?), the

position of which was approximately fixed, and there appears no doubt that it is identical with the Kenge referred to by Major Darley in his notes on the upper Sobat basin,* and that it therefore receives the water of the Kuroni and Natilete rivers. Major Darley states that the latter is the head stream of the Pibor, differing in this point from Captain Pearson, who considers the Borghei to be so; the question cannot as yet be settled, but it is to be noticed that the Kangen has a surface flow in its lower reaches for a considerably longer period than the Lotilla.

Another tributary of the Pibor which was explored for a part of its course, was the river named Gwi by the Nuers, Agwei by the Anuaks, and Kongkong by the Beirs. This stream was followed for a distance of some 60 miles, and is apparently perennial; in the middle of March there was still a surface flow at its junction with the Pibor of a cubic foot per second, whilst about the same time there was water 3 feet deep over a width of 60 feet of its grassy bed throughout the course followed. The Kongkong differs from the rivers hitherto mentioned in that it has well-defined banks throughout, which seem to indicate a comparatively short course and a greater current of water during the flood season. There is but little wood along its banks, especially in the lower reaches, and it runs for the most part through an open grass plain with occasional patches of bush.

The Pibor, it should be noted, was dry at the middle of March, except for occasional pools to the south of the Agwei junction, whilst north of that point the water was then continuous, quite an appreciable current being further given by the Akobo, and after its junction with the Gelo or Jilla rivers, it had a current of some 2 miles an hour. The last-named river is evidently the principal dry-season affluent of the Pibor, and probably of the entire Sobat basin also.

From the above brief sketch of the exploratory work accomplished it is increasingly evident that very much remains to be done before the southern portion of the Sobat basin is thoroughly known, and the results of the surveying expedition which is leaving Khartum under Captain Pearson in June to explore the various rivers by steamer, will be awaited with interest.

The tribe, against a section of which the expedition was directed in punishment of repeated raids on the peaceable Dinkas of the Bor district, is probably very widely spread. Called Jibba by the Nuers and Berri by the Dinkas, the people called themselves Murrlen, but speak of Jubba and Beir as being alternative names of the tribe. It will be interesting to ascertain whether the Berri of Jebel Lafon, the Merlerrim between Jebel Musingok and Jebel Harogo, the Ajuba of Jebel Lafit, the Jiwe north of Jebel Kisingore, and the Murille north of Boma had originally any connection with each other and with the Beirs now to be described, although speaking different dialects and possibly differing also in

* *Geographical Journal*, March, 1912, p. 282.

appearance and habits. Major Darley, in his notes on the upper Sobat basin, which have already been quoted, connects the Jiwe by dialect with the Toposa, the Turkana and the Masai, whilst he groups the Mulile on the Akobo (Murille ?) with the people of Jebel Lafon. The Beirs, who were visited by the present expedition, are a cattle-owning tribe, and the cultivation of grain is confined to a few of the aged people who are unfit to move about. Their herds are exceedingly numerous, and during the dry season are moved continually from place to place for grazing. The downward and inward growth of the horns, which is induced by permanent ligatures of cord, seems to be peculiar to these cattle, and is a precaution that the bellicose propensities of many of the bulls showed to be most necessary. In common with the Nuers and Dinkas, the Beirs build small temporary grass shelters for the dry-season camps, but unlike these tribes, they do not appear to devote any great attention to their permanent or wet-season villages. The permanent huts, situated of course on rising ground, are of exceedingly rough construction, consisting of grass laid on a dome-shaped framework of branches, a half dome of the same construction being, as a rule, added in the form of a porch. Their staple food is milk and blood, the latter being obtained by a periodical bleeding of the bulls at the back of the neck. A certain amount of game is speared or trapped, and the rivers produce quantities of fish, which are speared in the dry season and caught in wickerwork weirs at the time the rivers begin to fall. It is curious that nothing in the shape of a boat was seen on any of the rivers which we visited. The tribal organization appears to be on the patriarchal system, and there are four sub-sections between which there is little cohesion. The young warriors, who are generally of fine physique, wear their hair dressed in almost the exact shape of a flattened Wolseley helmet, forming a felt-like substance which is edged by a twisted cord of natural hair. In some cases the construction is ornamented by a pattern worked in beads, while occasionally a finishing touch is given by large bunches of ostrich feathers. The wealthiest and principal men wear a heavy dome-shaped helmet of closely woven fibre, chiefly covered with small red and white beads, and many also wear a large bunch of giraffe tails attached to an armlet of plaited leather which is ornamented with cowrie shells, and is fastened above the elbow of the left arm. Their shields are of cowhide, oblong in shape with projecting horns on the four corners, the top being often adorned with a pom-pom of black ostrich feathers. The blade of one of the spears carried is often kept in a leathern sheath in two halves that are drawn together by a leathern string. Most of the men were entirely naked, but some wore an apron of tanned hide behind; the majority also wore a species of "chest protector" of skin with the hair outwards, suspended round the neck. The two centre incisors of the lower jaw are extracted and many men wear a small cylindrical piece of bone about 2 inches in length passed through a hole between the lower lip and the chin.

The women wear aprons of tanned hide, ornamented sometimes with cowries. Some wear under the lower lip the bone ornament which has just been mentioned, while others have a large hole pierced without wearing any ornament in it, but when in meditative mood they have the habit of putting the point of the tongue through this hole instead. Both men and women were distinguished among Sudanese natives by the quietness of their voices, those of the women being almost melodious. No signs of graves were seen, and probably the aged and dying are exposed.

Their personal adornments and household implements show that the Beirs are by no means wanting in an artistic sense; their earthenware water-jars are beautifully moulded and are provided with delicately made handles, a most unusual feature in the Sudan. Not only their successful raids but the methods which they employed during the present expedition prove that they possess the military instinct strongly; their system of scouting and the method of covering their tracks were excellent, whilst their bravery was beyond dispute.

It would appear that, apart from occasional raids, very little communication takes place between the Beirs and their neighbours; iron and beads are brought down at the beginning and end of the rainy season by the people of Boma and Lafit, but the comparative scarcity of bead ornaments was conspicuous. The establishment of a military post in the centre of the Beir country will soon, it is hoped, bring the people into close touch with the Sudan Government, and will afford an opportunity of studying these exceedingly interesting and quite unspoilt people, who are perhaps one of the finest types to be found in the Sudan.

SIR WILLIAM WILLCOCKS'S SURVEY IN MESOPOTAMIA.*

By Captain H. G. LYONS, F.R.S.

In preparing a scheme for the reclamation of Mesopotamia by placing its irrigation on an efficient basis, Sir William Willcocks and his staff under Mr. B. T. Watts carried out a large amount of levelling in the northern half of the great alluvial plain which lies between the Tigris and the Euphrates. Main lines of levelling were run with two levels working side by side in one direction, and nearly all the secondary lines were run in the same way. Time did not admit of levels being run both to and fro, but the differences between the readings of the two levels were not great, and in traverses of over 200 kilometres in length the final difference fell usually between 0·1 and 0·2 metre. Distances were determined with stadia wires in the level telescopes. The work, therefore, was of a satisfactory standard of accuracy, and furnishes us with a very large

* Map, p. 588.

number of altitudes, which depend on a mean sea-level which was determined by observations made on January 11 and 12, 1909, at the head Khor Abdullah, about 25 kilometres south of Basra, at the head of the Persian gulf. The results of this survey are given in Plan No. 2 of Sir W. Willcocks's Report on the Irrigation of Mesopotamia, and the map given in the present number has been prepared from it, the metric values for the points determined by levelling having been converted into feet, and contours having been drawn in at 10-foot intervals from the points located by the levelling. In this way an instructive plan of the northern plain of Mesopotamia has been produced which exhibits many features of interest.

On the north the river Diala divides in a number of arms as its valley opens out into an alluvial plain, which slopes at about 1 in 2500 to the plain of the Tigris. The various branches give off numerous secondary distributing channels, the whole forming an instructive delta system of which some of the main channels extended in the past as much as 100 kilometres beyond their present limit.

To the west of the Diala the Tigris enters the Mesopotamian valley, and the levelling carried up to the 35° parallel shows that for about 70 miles it flows in a comparatively narrow valley which is bordered by a steep slope on its right bank, where the country rises rapidly to 400 and 500 feet above sea-level. Up to the point at which the first contributions from the Diala river reaches its valley the Tigris flows in a well-defined valley, but as the great alluvial plain is reached the characteristic forms of alluvial deposition appear, the contours curve strongly forward, showing that rapid deposition of silt has raised the banks of the river above the plains on either side. The 120-foot contour first shows this markedly on the Tigris, and the 130-foot contour on the Euphrates indicates the same constructive action of the river. From the northern extremity of the great alluvial plain near the city of Baghdad, where the surface is at an altitude of from 110 to 120 feet above the sea-level, the country slopes seaward, being enclosed on the west by a desert plateau which rises 100 feet or so above the plain. On the eastern side so far as the levelling was carried the ground seems to rise very gradually for some distance. It will be seen that the portion of the plain which is included in the map has a lateral slope from the Euphrates onwards, and that levels near the former river are about 10 feet above those at corresponding points near the Tigris. Thus, the water of the Euphrates can be distributed over the intervening plain by numerous channels.

The constructive action of the rivers in building up this great alluvial plain is well shown by the contoured map; not only are there strips of higher ground corresponding to the present courses of the Tigris and the Euphrates, and also to those of the Shatt el Hai and the Shatt Hilla branches, but others which coincide with ancient canals, or probably slightly modified river arms, are clearly shown, and their relation to ancient sites is evident. Between such lines of deposition lie patches of lower ground,

which in the north have already been silted up to form habitable land, but further southward are still unreclaimed marshy tracts.

The course of the Euphrates is much straighter than that of the Tigris, which in this portion meanders considerably, and has a meander belt 10 kilometres wide, while that of the Euphrates is less than 5 kilometres.

THE SONORA DESERT, MEXICO.*

I.

By Dr. CARL LUMHOLTZ.

During the years 1909 and 1910 I was commissioned by some influential friends to look into certain economical possibilities of the arid and little-known country along the upper part of the Gulf of California, east of the Colorado river. My field embraced most of the district of Altar, in the State of Sonora, Mexico, as well as the southern part of the newly admitted state of Arizona; in other words, the region which by the early Spanish chroniclers was designated as Papagueria, after the native inhabitants, the Papago Indians. Some of this country, being the least accessible part of the Sonora desert, is singularly little known, though lying, so to speak, at the door of the great empire of Yankee enterprise. My mission gave me an opportunity for geographical and ethnological studies, a short summary of which is hereby presented.

The extreme western part of this region, the sandy country between Pinacate and the Colorado river, so far as my knowledge goes, had not before been investigated. The travels here of the Jesuit fathers during the seventeenth century did not extend much south of the present Mexican boundary. Some of that country probably had not before even been visited by a white man, that is at least the opinion of Mexicans living furthest west then.

Although most of that arid region will always remain suitable only for cattle and horse-raising, still there is more of it than people realize which can be brought under cultivation. I may mention the extensive valley which, south of the Mexican boundary-line, runs east and west, passing beyond Sonoyta, the great plains north-east and south-east of Pinacate, as well as the middle course of most of the flat valleys; for instance, many of those between the Gila range and the ranges following as far east almost as Silver Bell, extending in the west as far north as the Gila river. The problem of water is bound to be solved at some future time, as soon as the necessity arises. Water may be found at a depth of from 50 to 100 feet; but at most places one would have to go several hundred feet down. Judging from the remarkable springs I encountered on the shore of the salt deposit, Salina Grande, near the coast, there must be a large sheet

* Royal Geographical Society, June 24, 1912. Map, p. 588.

of fresh water underneath most of that western coastal desert. This inference seems to be confirmed by the flow of water which was found in digging the well near Horseshoe, in the Quijotoa range.

The mineral prospects of the region, especially as regards gold, are great, the western Papagueria being part of a great auriferous belt that stretches southward from California and Nevada. Many placer mines were discovered in north-western Sonora during the last century, among them the Cieneguilla, where, according to J. F. Velasco, gold was gathered "on the surface in the same way as fowls pick up corn." Free gold has of late been encountered in the malpais in the northern part of Pinacate.

The extraordinary adaptation to arid conditions of plant and animal life, even the domesticated animals of Indians and Mexicans subsisting without difficulty for months without water, cannot help but interest the observer. With the exception of the Seri and Pima Indians, the natives of the desert have so far received little attention from those engaged in the study of primitive races. The Papagoes are the great desert people of America, and are remarkably stable in their racial characteristics, still preserving traditions and habits of the past which will soon disappear. There are also ancient remains left since the occupancy of that same country by people who had a higher state of development than the present-day Indians. Among these should be mentioned Trincheras, in the district of Altar. This is the name applied to certain fortifications in the shape of somewhat narrow terraces, some of them reaching a length of 2000 feet, which rise along the northern slope of a 400-feet high mountain, one above the other, to the number of twenty. These stone terraces were probably of religious importance, serving at the same time as places of refuge in case of need.

The main part of the Papagueria slopes down from an elevation of 3000 feet or more, in south-eastern Arizona, slowly, and to the casual observer imperceptibly, for some 200 miles towards the Gulf of California; its northern part gradually descends toward the Gila river. A striking feature in its topography is a number of minor mountain ranges or sierras, varying from 7 to 30 miles in length, and running more or less in the same general direction of south-east to north-west. Their usual elevation above the sea may be placed at 3000 to 4000 feet, although some in the north rise as high as 9000, and some in the south are as low as 1000 feet. The mountains have undergone a tremendous erosion and at a distance give the erroneous impression of being entirely devoid of plant life. Often the zigzag profile of their crests resembles a flash of lightning. Oddly enough, the veins of ore very often follow the same general direction as the sierras, south-east to north-west. The geological formation is granite and recent volcanic.

Near the coast runs a belt of sand-dunes, usually 8 to 15 miles wide, from Port Lobos northward, with many ramifications. The Mexicans use the euphonious name médanos for the sanddunes, great and small; in

fact, the whole region along the upper part of the gulf east of the Colorado river is thus designated. The name has an almost mystic sound, suggesting in the summer aridity and danger, fierce heat, rattlesnakes, and other reptiles—in the winter cold, wind, fog, and occasional drizzling rain.

Most Mexicans are afraid of los médanos, as they themselves have told me, on account of the risk of losing animals and of the troubles in general connected with travel there. There is nothing depressing, however, about these sanddunes. In the late afternoon sun, when seen from the north, they look especially picturesque, running in the northern part of the belt in long, majestic, though somewhat uneven waves. The sand is of a light roseate hue. One of the high sandhills which I measured, was found to be 185 feet in height, and at least 2800 feet long.

This region, no doubt, recently had a less arid climate, with much greater rainfall than at the present time. It seems impossible to explain otherwise the recent great accumulation of detritus at Sonoyta, at the origin of the little river of the same name, which has the distinction of carrying water permanently for 7 miles. At the depth of 18 feet below the surface I here found stone artifacts which do not differ materially from those seen among the Indians to-day. Neither does the marked polishing effect of the water on the hard andesite rocks at Tinajas de los Papagos, in Pinacate, seem to admit of any other explanation. The prevalence of dry, generally large arroyos with gravelly or sandy beds is probably also evidence of a heavier rainfall than these regions now have. A point in the same direction is the presence of a deluge legend among the natives of this arid region. That country is a desert, on account of the scarcity of rain, but the soil is in places extremely fertile, and I doubt not that through human agency large parts of it will some day delight the eye with waving fields of grain and orchards of fruit.

Few of the so-called rivers retain water for more than a few hours after a downpour of rain, and the few that show permanent water in certain limited localities, as, for instance, the Santa Cruz river in Arizona, lose themselves in the desert, or, as the Altar and Sonoyta rivers in Sonora, reach the sea only after a heavy rain.

As so few rivers have a permanent water supply, water has often to be sought elsewhere. In the mountains it is found where natural conditions favour the gatherings of rains into kettle holes or sockets, forming what the Mexicans call *tinajas* (natural tanks). They are nowhere common, and some sierras do not contain any. In the south-western part of the Papagueria, toward the Colorado and Gila Rivers, such tinajas are the only water to be found. Some last only a few months before evaporating; others, having a capacity of a few thousand gallons, may last a year or two.

On the coast water is, as a rule, only found by digging for it, and a spade is here an essential part of the explorer's outfit. For three weeks we here had water more or less brackish to drink. It may be noted that

where bulrushes (*Typha latifolia*) grow near salinas or salt lagoons, they are indications of fresh water.

On the flat shore of a large salt deposit, near the coast, 2 miles long, and which I called Salina Grande, I encountered 16 fresh-water springs. They each appeared in curious, circular formations, from 20 to 200 feet in diameter, of greater or less regularity of shape. The best preserved ones, stripped of their growth of bulrushes (*typha*) and other plants, resemble shallow craters, most of which were filled by a hill in the middle. The rim would rise 1½ feet or more above the surface, and the hill inside would usually be about 5 feet high. Not only was an abundance of fresh water found in the depression inside the rim, but even on the top of the sand-heap inside, one of which measured 10 feet in height. The composition of the reservoirs was the same as that of the shore or playa—sand with an apparent mixture of clay. The nearest mountain range here is the isolated Sierra del Rosario, 35 miles to the north, and sanddunes are characteristic of the country for miles further on.

The annual rainfall is irregular; at Fort Yuma, on the Colorado river, it does not quite reach 3 inches. In June the surface of the soil during the day was so heated that I could not stand on it comfortably unless I wore thick-soled shoes. In spite of excessive heat in the summer, reaching at times 125° F. in the shade, the nights are always cool, and the climate is salubrious and even invigorating. During three months in the spring I travelled without wearing a hat, which made me feel comfortable and actually cooler. The one drawback to a journey in those regions is, of course, the want of water, and, because of this, caution is necessary, but this need not interfere with the enjoyment of the freedom of the wilds. Unusual glow of the sun before rising was observed several times, on one occasion the sun shining 27 minutes before rising. Also unusual after glow at sunset was often noted.

During the year I spent in that region I never saw any plant, bush, or tree suffering from want of rain, in spite of the fact that the winter passed without its customary showers. Next to the cacti, the juicy pulp of some of which may save the thirsty traveller's life, the greasewood (*Larrea tridentata*) is the most characteristic of the region, sometimes giving the plains from a distance, the appearance of vast expanses of yellowish-green; it is interesting on account of its highly antiseptic qualities. Certain kinds of grass are found, though sparingly, the domesticated animals largely resorting to the leaves of the mezquite or the palo fierro (*Olneya tesota*).

In ordinary years one may, among the sanddunes, encounter a remarkable flora. In spite of the lack of rain during the winter previous to my visit to the dunes during spring, I found at one place an astounding growth of flowers, through which we travelled for nearly 3 miles. There were four species, the one most in evidence being the beautiful *Oenothera trichocalyx*.

It has been found by actual experiment that small rodents of arid

SALINA DEL PINACATE, THE OBJECTIVE POINT OF MOST OF THE PAPAGO SALT EXPEDITIONS.
(By permission of Messrs. Chas. Scribner.)

THE SOUTH-EASTERN END OF SIERRA BLANCA.
(By permission of Messrs. Chas. Scribner.)

ŒNSTHERA TRICHOCALYX.
(By permission of Messrs. Chas. Scribner.)

DIGGING FOR *AMMOBROMA SONORÆ.*
(By permission of Messrs. Chas. Scribner.)

regions have been able to live for two or three years on hard seeds without water. The animals of the desert certainly impress one as having made themselves considerably independent of the water question. Certain it is that domesticated animals of arid regions are much more enduring than those of moister regions. A certain choya (*Opuntia mamillata*) furnishes for at least three months of the year the staple food as well as the only drink of the cattle of one part of the district of Altar. Both cheese and butter are made, and the milk from the cows that eat choya has the reputation of being very good. I was assured that, even if driven to the dam, the cows did not care to drink.

The conditions in the sanddunes near the coast are if possible, even more remarkable. Here one or two species of plants which the scanty winter rains call into existence serve the same purpose, especially the green and juicy *Oenothera trichocalyx*. As soon as the uncertain rains of winter have made los médanos "green," as the Mexicans say, the cattle and horses are driven there and remain three months, from February to the end of May, absolutely without water. The cattle do not gain flesh, but sometimes die from excess of fat.

Even horses do not come in to drink of their own free will every day during the winter. In my travels it was the usual thing during the winter time for our animals to go without water every second day; such is the custom of that western desert country, and its animals are in surprisingly good condition. On three occasions, in March, our animals, travelling during the day, had no water for seventy-four hours. It was only the horses that suffered, and this was more from the quality of the water than from the lack of it.

The Papago Indians are a Piman tribe and speak the same language as the Pima Indians with some variations of dialect. Their number reaches perhaps four thousand five hundred, of whom not over seven hundred live in Mexico. In spite of the efforts of the Jesuits and Franciscans the Papagoes are still living in their rancherias as of old, half-nomadic in habit, resorting in the winter to the sierras where water is more plentiful and where their cattle, horses, mules, and donkeys find good grazing ground. In the summer they move to the broad, flat valleys to devote themselves to agriculture which is made possible by the aid of the showers that fall in July and August. They do not usually pursue irrigation beyond the diverting of rain-water into ditches. By scooping up the earth they make dams in which rainwater is stored for household use as well as for their domestic animals. In the summer they raise maize, beans, water-melons, and squashes; and in the winter, when infrequent light showers usually may be depended upon, peas, barley, and lentils may be planted, all on a small scale, according to Indian habits. Wheat, which is grown in November and harvested in May, is now the most important crop, and one good shower at the time of sowing is considered sufficient to ensure a good harvest.

Thus the Papagoes, though sedentary Indians, have distinct habitations for summer and winter, the former being called by the Mexicans temporales. As implacable enemies of the Apaches, the Papagoes were of some assistance to the early missionaries. Their innate enmity to this tribe later gained them the favour of the Americans, who received their valuable assistance in campaigns against these marauders. They also ensured the goodwill of the Mexican Government by assisting in the war against the valiant Yaqui Indians. It has been the good fortune of these Indians to live in a country which the white man as yet has not found it profitable to exploit by cattle raising, or, still less, by dry farming. Therefore they have been so far left alone in their native country.

Although the Papago in Arizona always insists upon speaking his own language, still he is rapidly losing his aboriginal beliefs, customs, and habits; even basketwork, for which the women of the tribe were noted, is falling into decay, and he has adopted the white man's way of dressing. Tattooing marks in the face are still seen in the Santa Rosa valley. These Indians had not before been studied, and I was glad to have visited them while there was still something of the ancient atmosphere left in the more remote parts of the Papagueria. The fact is that decided changes in the conditions of the Papago have come about comparatively recently, perhaps during the last thirty or forty years.

These natives are naturally very healthy and many grow to be a hundred years old or more. They possess much force of character, are quick of perception, loyal to the white man that they like, and if in danger do not cry for help. Under her natural bashfulness the woman hides sterling qualities of efficiency in household work, constancy, and faithful adherence to duty. The Papagoes are industrious and have a remarkably even temper; thirty children may be seen playing harmoniously together, where a similar gathering of small Caucasians would soon result in discord, fights, and tears. The children and young girls have three kinds of chewing gum. The language is not sonorous, as it is full of guttural sounds and half-pronounced syllables. Their tribal name is O'otam, "people." Four is their sacred number.

In his changed habits of life, inhabiting houses that do not admit air, and adopting clothes that debilitate his magnificent physique, the Papago, when he catches cold, is unable to throw it off in the same way that a white man does. It very often develops into pneumonia and consumption, which awful disease is the scourge of the tribe, nine out of ten deaths being due to tuberculosis. The children bring it from school, and even old people die from it, having acquired it through contagion. Although in no way a prison as to its restrictions, nevertheless the school as at present conducted does them harm physically. The confinement, to which they have not been accustomed, seems to undermine their health. Until recent times the Papagoes were in the possession of wooden hoes, of which I was able to collect eleven specimens. They still make expeditions

to fetch salt at certain salinas on the coast, the principal of which is south of Pinacate. The members carry ceremonial sticks to be deposited in different localities, and sacrifice corn-meal to the sea. They learn new songs on the trip, dreaming them while asleep. Among the gifts of the sea may be a beautiful wife, luck in hunting, or swiftness in foot-races.

At present it is very rare to find a Papago with more than one wife. The position of woman is equality with man. To be sure, the man never carries burdens, but she is the mistress of the house. Certain periods of female life are looked upon with awe, even by the civilized Papago. A girl in this condition could not touch her hair. When the girls come of age, dancing and singing are kept up for eight nights in succession in a very fatiguing fashion.

According to Indian reports, a woman caught in adultery used to be punished with death. Whipping has been the penalty, and the custom of killing her animals still prevails. Intermixture to-day rarely takes place except in Sonora, where the Mexicans have taught the Indians new customs. The tribe is divided into five groups, descent being in the male line.

The religion of the Papago is not regulated by exterior observances to such an extent as is the case with many other Indian tribes, still they have certain elaborate dancing festivals, the most important of which is connected with the harvesting of the fruit of the giant cactus (*Cereus giganteus*), and takes place shortly after midsummer. This cactus, called by the Mexicans sahuaro, is by far the most noteworthy representative of plant life in the Papagueria, within the confines of which its habitat is almost entirely limited. The grateful fruit comes at a time when most needed, and the Indians leave their habitations to camp among the sahuaro as long as the season lasts. Not only does the fruit then furnish them with their principal means of subsistence, but the greater part is boiled down to a syrup, which serves as material for an intoxicating drink, used at the sahuaro festival. The seeds are also eaten after having first been ground on the metate. The wooden skeleton of the sahuaro furnishes the Papago with light, strong building stuff. Even the wooden tissue bags, produced inside the stem by the woodpeckers, are made to serve as water-bottles or drinking-vessels. So important a part does this cactus play in the life of the Papago that their year begins with the sahuaro harvest.

Every fourth year so far a great harvest feast has been given at Santa Rosa, in southern Arizona, the last one taking place in 1908. On this occasion bull-roarers are used; the clowns wear some very interesting masks, and carry crude and make-believe bows and other foolish outfit, which in their ceremonial character seem to connect the Papagoes with the plains Indians.

Until forty or fifty years ago the extreme western part of this country was inhabited by a number of Papagoes, who, amongst the Mexicans, are known as the areneños, who managed to make a good living in an absolute desert. In hot weather they followed jack-rabbits in the loose sand until

the latter were exhausted, and caught musk-rats by burning the accumulations of cactus spines with which those animals keep enemies away from their burrows. With bows and arrows they killed mountain sheep (*Ovis canadensis*, Gaillardi), especially in the large craters. At certain seasons they went to the coast to fish, catching as many fish as they wished.

They found good edible plant food, as the chia, and the mezquite beans. For a couple of months their main means of subsistence was the remarkable *Ammobroma sonoræ*, a large and fleshy root-parasite which grows in the naked sanddunes. These roots are a specially delicious relish to thirsty man, and they also quickly appease his hunger. Apparently these highly useful plants might be transplanted to advantage to other desert regions of the earth. Its native name is híatatk, "root of the sands."

The clothing of these people was made from the skin of mule-deer, antelope, or mountain sheep. From the badger's hair they plaited ribbons and twine, and from the skins of sea-lions sandals were cut.

The Papagoes being very intelligent and not having, as a rule, suffered injustice from the whites readily accept civilization. The women are clever in adapting themselves to the new conditions, and often without being taught are able to make their own garments, and even those of their husbands. Music they also desire to learn. The future augurs well for the Papago as long as the Government's wise prohibition against the sale of brandy continues. There is no difficulty in civilizing the Indians, but a step in the right direction would be to civilize the rough whites first.

The PRESIDENT (before the lecture): The reader of the paper this evening, Dr. Carl Lumholtz, is a Norwegian by birth, and has long been known to our Society as a zealous explorer and anthropologist. Over twenty years ago he published a remarkable book on his journeys in Queensland, but for many years past he has devoted himself to exploration in Mexico. Nearly ten years ago he gave us a paper containing the results of some of his explorations in Mexico up to that date. Since then he has been diligently pursuing his work, and to-night he will deal with the desert conditions in the province of Sonora, in the north-west of Mexico, which seem to be in many respects similar to those dealt with by Dr. MacDougal in a remarkable paper on the deserts of Arizona, which some of you may remember as having been delivered in this hall in December last.

The PRESIDENT (after the paper): We have here Mr. Dracopoli, who was mentioned by the reader of the paper, and who has lent some photographs for exhibition. He is a pupil of our Mr. Reeves, and he has been in Sonora for about a year, doing practical survey work.

[Mr. DRACOPOLI's remarks are embodied on p. 511 *et seq.*]

The PRESIDENT: I think it will be your opinion that we have had to-night a paper of unusual and varied interest. I cannot say that I thought the country depicted by the lecturer was a very beautiful one, but he showed it to us as possessing a flora of unusual beauty, if we may judge from the pictures; a fauna, too, of very remarkable character, because both animals and birds seem to be able to dispense with water; and a human type possessing, if we may judge from the stories he told us, great individuality, character, and independence. But perhaps the most remarkable feature about these Papago whom he delineated to us was the fact that

they appear to have solved the suffragist problem. He told us that the gentlemen carry the burdens, as we know they have to do in our own and in most countries. The ladies, on the other hand, are the undisputed mistresses of the household —which is exactly what we think they ought to be. The domestic animals follow the female and not the male—a concession which the most confirmed anti-suffragist would be willing to make. And finally, it appears that the grandmothers do the singing. Well, I can only commend this, in these troublous times, as a real solution of the question which is so much agitating Society. I am sure you will wish that I should convey your thanks to Dr. Lumholtz for his lecture, which will always remain fixed in our memory not least by the fact that it comprised two excellent songs. This is a precedent which I shall hesitate to recommend to every lecturer at our meetings, but in which I am sure you will agree with me in thinking that Dr. Lumholtz greatly distinguished himself and pleased us to-night. May I be the spokesman of the sentiments of every lady and gentleman here present in saying how heartily grateful we are to him for his lecture?

II.

By I. N. DRACOPOLI, F.R.G.S.*

THE Sonora desert is that part of Mexico which is bounded on the north by the International boundary-line, on the west by the Colorado river and the Gulf of California, on the south by about the 29th parallel of latitude, and on the east approximately by the 111th meridian of west longitude. This large tract of country is singularly little known, though it contains much that is of interest both scientifically and commercially, and its previous exploration may be summed up in a few words. The Jesuit Fathers in the sixteenth century, though they visited most of what is now Arizona and New Mexico, only skirted the eastern edge of the Sonora desert. After the Gadsen Treaty, however, in 1853, a rough survey was made of the new International boundary-line between El Paso and Yuma, and this was revised and the monuments relocated in 1891. Good topographical maps were made of the country to the south-east of Altar and along the southern boundary of Arizona by the Mexican Government and the United States Geological Survey respectively, and a prismatic compass sketch of the Pinacate mountains was executed by Mr. Godfrey Sykes in 1908, while on a short hunting trip. It will be seen, therefore, that the greater portion of this country was a genuine *terra incognita*, and all the more interesting on that account.

The following is a brief description of the topography of this region, which has so long been neglected. Rising in Southern Arizona to an average height of 2000 to 3000 feet, the country slopes gradually, and to the traveller imperceptibly, down towards the south-west, until the coast is reached; and this great plain is characterized by a series of isolated mountain ranges, rising abruptly to an average height of 3000 feet, and often much more, and from 5 to 30 miles in length. These mountains usually run in the same general direction—south-east to north-west—thus dividing the country into a series of broad and sandy valleys. Many of the latter, such as the San Simon and the Baboquivari valleys, are of great extent, and appear from a distance to be great plains—the mountains bordering them, though of a considerable height, are dwarfed by the great spaces between them. Each is the hydrographical basin of a large section of country.

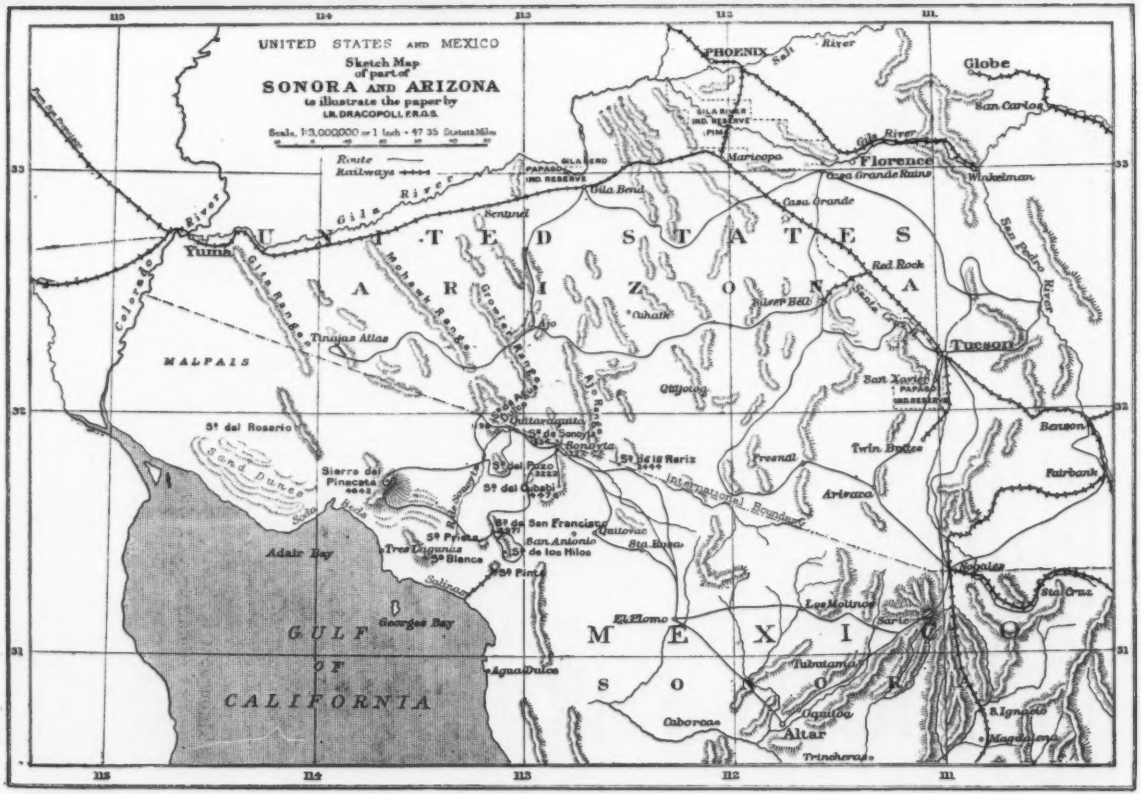
* Read at Section E, British Association, Dundee, September, 1912.

Some are sparsely clothed with grass (*Bouteloua crispoda*), but the majority are covered with the ubiquitous greasewood bush (*Larrea tridentata*), which is useful only on account of its antiseptic properties. The mountain ranges are in general a compact group of ridges and peaks, rugged in the extreme, with boldly serrated outline. They have undergone enormous erosion, and appear from a distance to be devoid of plant life. Their average height varies between 3000 and 4000 feet, though some in the north rise as high as 9000 feet.

Probably the most marked topographical feature apparent in the map of this region is the sharp contrast between mountain and plain—a contrast which, while in no way exaggerated, is perhaps even more striking on a map than on the ground: for the traveller, passing through the arid portions of New Mexico and Arizona, has usually had the same features repeated before his eyes again and again long ere he reaches the Sonora desert. Though the mountains appear to rise almost perpendicularly from the plains, there is a slight increase in the inclination of the valley floor, as the base of the mountains is approached owing to the accumulation along their front of coarser fluviatile material; but this increase, however, is too slight to detract from the abrupt change in slope, which generally corresponds with the boundary between the sandy floor of the valley and the older rocks. The general geological formation of the mountain masses is granite and recent volcanic. They are highly mineralized, and traces of copper and gold are common in many parts.

Round and to the north-west of Adair bay is a broad belt of sand-dunes, at some points 20 miles, but in general 5 to 8 miles in breadth. They run in long and irregular waves, some 150 feet in height and upwards, and are of a beautiful golden colour. Their formation clearly indicates the prevailing character of the wind, for they rise up from the south-east in long gentle slopes until the crest is reached, and then subside very steeply towards the north-west. They are almost devoid of vegetation, and travelling over them is a matter of great difficulty and extreme slowness. It is a curious fact, that although on their northern border water is non-existent, along the sea coast there are two or three fresh-water springs at a considerable distance apart: that these springs are separated from the nearest mountains, 40 miles away, by a broad belt of waterless and arid desert makes it all the more remarkable.

The rainfall in this country is very irregular: in the south-east and north-east it varies from 12 to 16 inches; at Yuma the mean yearly rainfall is 3 inches; and in the Malpais, between the Colorado river and the Pinacate mountains, it is often less than that. Not only, therefore, is the annual precipitation in this region, as a whole, insufficient to maintain vegetation of such character as might serve as a protective covering to the hill slopes, but it falls in a manner to accentuate this deficiency. The violent summer rains descend, as a rule, upon hills that have been parched by months of burning sunshine, during which all herbaceous plants have become shrivelled and brown. The bare ground is directly exposed to the wash of the rains and the finer particles of disintegrated rock that might, if undisturbed, have become soil, are swept down into the valleys. Having reached the foot of the mountains, the water, no longer held within cañon walls, spreads out as a sheet, which becomes rapidly thinner as it advances into the valley, deposits its burden of sediment as a thin wash of boulders, gravel, and sand, and unless the shower is unusually prolonged, soon sinks out of sight within the porous accumulations of earlier floods. Thus the vigorous erosion of the mountains is out of all proportion to that of the valleys, and but a small portion of the material carried down from the mountains is in turn borne to the sea. The valley floors thus become burdened with detritus, and the mountains are slowly being


UNITED STATES AND MEXICO
Sketch Map of part of
SONORA AND ARIZONA
to illustrate the paper by
LR. DRACOPOLI, F.R.G.S.
Scale, 1:3,000,000 or 1 Inch = 47·35 Statute Miles
Route
Railways
PHOENIX
Salt River
Globe
San Carlos
Gila River
Florence
Casa Grande Ruins
Winkelman
Maricopa
Casa Grande
Sentinel
Gila River
Yuma
Colorado River
Gila Bend
Mohawk Range
Growler Range
Tinajas Altas
MALPAIS
Sand Dunes
Sierra del Pinacate
Adair Bay
GULF OF CALIFORNIA
Georges Bay
Salinas
Agua Dulce
Ajo
Quitaraqui
Sta Rosa
Sonoita
Sta Ines Nariz
Sta del Pozo Verde
Sta del Oposto
Sta Teresa
Tres Orejunias
Sta Blanca
Sta Pinta
Bta de San Francisco
San Antonio de los Milos
Quitovac
Sta Rosa
Int. Boundary
Presidio
Twin Brothers
Arivaca
Tucson
Red Rock
Silver Bell
Cababi
Quijotoa
San Xavier
Benson
Fairbank
Nogales
Sta Cruz
Los Molinos
El Elomo
Tubutama
Oquitoa
Altar
Caborcas
Trincheras
S. Ignacio
Magdalena
UNITED STATES
ARIZONA
MEXICO
SONORA

encroached upon by the growing waste slopes. An admirable example of this is to be seen in the gradual burial of the Sierra del Rosario, to the south-west of Pinacate.

As in other desert regions, precipitation is due here almost entirely to local atmospheric disturbances, cyclonic in character, extremely irregular and often violent. These heavy storms, when they do visit a certain part of the country, yield more water in a few hours than is received by the ordinary precipitation of many years. The deluge scours out a channel which is far too deep and broad for ordinary needs, and which years, if not centuries, may not suffice to efface. The abundance of "arroyos," or deep dried-up stream-beds in various stages of obliteration, but all manifestly unsuited to the everyday conditions of the country, have led people to believe that an age of much greater rainfall has but just ceased in the Sonora desert—a theory which I believe to be erroneous, for the above-mentioned reason.

Though on the whole the country is a desert, owing to the scarcity of water, the soil in the valleys especially is very fertile. In the Sonoyta valley, for instance, where there is permanent water in the bed of the Sonoyta river for a few miles, the Indians are able without any difficulty to raise all the food they need, and grow tobacco as well. And the same thing is to be seen everywhere where there is a permanent spring, or where the land is irrigated from a well. Moreover, there are unmistakable signs of an abundant underground flow of water at no very great depth, which should make much of this valley land valuable for agricultural purposes.

In spite of the great heat of the summer months, the climate is unusually healthy and even invigorating. As in all countries where evaporation is rapid, the daily range of temperature is very great, there being often a difference of 40° or 50° Fahr. between the maximum and minimum; 120° in the shade is not at all uncommon in the day-time, but the dryness of the air prevents the heat from being oppressive, while the nights are nearly always pleasantly cool.

In order to fix the geographical positions of the main mountain ranges, I determined to carry out a rapid triangulation of this district and to fill in the detail by means of a plane-table. Thanks to the kindness of the American Geographical Society, I was able to extend the existing triangulation in Arizona, and thus to fix the positions of the main peaks with very fair accuracy. It was impossible under the circumstances to observe the three angles of every triangle, but a check was obtained by constantly referring back to the various International boundary monuments, whose latitudes, longitudes, and azimuths were known. Owing to the high cost of native labour, which was to a great extent due to the revolution then raging in Sonora, Sinaloa, and Chihuahua, I was compelled to carry out all the survey work with the help of two untrained natives only; consequently it was impossible for me to complete all the detail work I meant to do. Throughout the survey I used a 4-inch theodolite, fitted with Reeves' patent tangent micrometers. I found them greatly superior to the vernier and to the usual type of micrometer, and far less liable to get out of order, though the conditions of climate and transport put them to the severest test one can well imagine. Mr. Reeves mentioned in his paper on "Recent Improvements in Surveying Instruments," the use of the astronomical compass in conjunction with or in place of the prismatic compass in plane-tabling. In practice I found the former invaluable, especially when working in the lava-fields round Pinacate. Here the local attraction was so great that I had to discard the prismatic completely, and rely on the astronomical compass alone, and I found it most convenient in every respect. It is also very useful for quickly obtaining local mean time.

SERI INDIANS, WOMEN AND CHILDREN. TIBURON ISLANDS.

SANTA CATALINA MOUNTAINS, WITH GIANT CACTUS (*CEREUS GIGANTEUS*) IN FOREGROUND.

The flora of this region cannot fail to interest the traveller. Some of the plants are quite local in character, and all are wonderfully endowed by Nature with means for obtaining and storing water. All the trees, shrubs, and cacti are perennials, and have enormously long roots. The Mesquite (*Prosopis juliflora*) and the paloverde (*Parkinsonia torreyana*) are the most common trees, of which the former bears a kind of fruit or bean, which the Indians grind into flour. While travelling in the "Malpais" of Sonora, I was obliged to rely for one whole month on these mesquite beans alone to feed my horses and pack-mules, and it says much for their nutritive value that I lost no animal during that time, and only one mule seemed to be suffering towards the end.

Found throughout the low-lying country is the Sonoran greasewood (*Larrea tridentata*), which on the higher plateaux gives way to the soapweed cactus; but the plant which is really characteristic of the Sonora desert is the cactus, which abounds in a variety of forms. They all have long roots, some of which descend 30 feet to reach water. The stem is formed of pulp that grows around a wooden core and serves as storehouse for the water they obtain, and this in turn is covered with a kind of glazed epidermis to prevent evaporation. Most of them are furnished with thorns, some of which are poisonous. Of the various species the most imposing is the "giant cactus" (*Cereus giganteus*), which often attains a height of 50 to 60 feet. It may be seen in vast numbers on the plains and on the lower slopes of the mountains, and it assumes an infinite variety of shapes, ranging from the single stem to those containing fifteen to twenty arms. To those who see them for the first time they present a remarkable sight, especially when they are in flower, for at the end of each branch they bear a wreath or crown of fragrant yellow, rose, or purple flowers. No less unusual are the pitahaya (*Cereus thurburi*); they grow in clumps of fifteen to twenty stems, and reach a height of about 20 feet. A rarer cactus is the barrel cactus (*C. bishaga*), a smaller form of the giant cactus. It is especially valuable to the thirsty traveller, as it yields from two to four pints of fairly palatable water. Another remarkable plant found in this region is the "ocotillo" (*Fouquiera splendens*). Attaining sometimes a height of 20 feet, it consists of a number of long, thin branches, covered with thorns, and bears the most brilliant scarlet flowers.

It is chiefly on these plants that the wild animals live, for the juicy pulp of the cacti provides them with sufficient moisture to quench their thirst, and the mesquite beans, and chollas (*Opuntia mamilata*) form practically their only food. The wild animals, at any rate, seem to thrive on this diet, and do not appear to mind going without water for days at a time.

Perhaps the most interesting animal peculiar to this region is the Sonoran Bighorn (a local subspecies of the Rocky mountain sheep), described as *Ovis canadensis galliardi*. Very little was known of this sheep, until my brother and I brought back several specimens, and they have proved to be distinct in many particulars from those found near Lake Santa Maria, in Chihuahua (*Ovis mexicanus*), and from those inhabiting northern Lower California (*Ovis cervina cremnobates*). But they have one common characteristic—the length of their ears, which is about 2 inches longer than those of the northern Rocky mountain sheep. Mr. R. Lydekker, in writing of these Sonoran Bighorn, mentions this, and raises the following curious point: That there is a progressive increase in the length of ear as we proceed from high to low latitudes. For this I suppose there must be some good reason. Can it be that sound is more concentrated in a cold than in a hot climate? A part of the difference in this respect may be accounted for by the fact that many desert animals have unusually large ears; but this will not explain the steady increase in this respect as we go south.

Most of the mammals of this region differ slightly from those found further north, especially as regards colour, but these differences are generally due to the exceptional circumstances surrounding them, or to the heat and aridity of the country they inhabit.

The southern part of Arizona and the north-western region of the Sonora desert are inhabited by the Papago Indians, a semi-nomadic tribe of Piman stock; they are physically a very fine race, and are of a peaceful disposition. Having helped the white men to fight both the Apache and Yaqui Indians, they have been rewarded by being left unmolested, and so retain to-day not only their religion intact, but also many of their old customs. In winter they resort to the foothills and live by hunting the Bighorn, deer (*O. couesi*), antelope, and rabbits. They are nearly all well armed to-day, but only ten years ago the bow and arrow was all they had. In summer they return to the low-lying plains, and sow a little corn in the "temporales," as the Mexicans call their summer habitations. In spring they hold an important religious ceremony, which lasts for several days, at one or other of their sacred meeting-places, but generally in the Santa Rosa valley. On these occasions dancing is kept up continuously, and prayers and offerings made for an abundant harvest of the fruit of the "saguarro," or giant cactus. Once each year they make a journey down to the coast for salt, and this is also an occasion for much religious ceremonial.

The Sierra del Pinacate are held in great veneration by them, for it was here that their god first descended on earth, according to an old legend. I was fortunately able to find and enter the cave or temple which they dedicated to him, and in it I found a great quantity of prayer-sticks, arrows, etc. I believe the former to be the offerings of a now extinct branch of the Papago, called the Arenaños, or "dwellers in the sand," who used to inhabit the Pinacate mountains, and traces of whose habitation I found in many places; for the prayer-sticks now used by the Papago on their journey to the coast are much smaller, and are not coloured.

The coming of civilization has been by no means an unmixed blessing to them, for it has brought with it, among many other horrible diseases, the scourge of consumption, which is reducing their numbers in an appalling manner. The United States Government have very wisely forbidden the sale of all spirits to Indians; in Mexico, however, there is no such restriction, and consequently whisky and mescal, for which the Papago has an unbounded love, are contributory causes to their moral and physical downfall.

As Prof. Ellsworth Huntington points out, Southern Arizona contains traces of a numerous pre-Columbian population in the shape of almost obliterated village sites, quantities of broken pottery, and flint arrow-heads and implements. I found a like condition prevailing in Sonora, even among the sand-dunes and in the very arid country round the Sierra del Pinacate. Moreover, throughout Papagueria hieroglyphics or "rock paintings" are to be found carved in the face of smooth rocks or cañon walls. Crude in execution, meaningless to us, and sometimes even absurd in shape, they yet form a subject of absorbing interest. They represent the first artistic record of ancient, if not of primitive man, and afford a glimpse into the psychological workings of the minds of those early people in their struggle upwards. The best example of these rude drawings that I have seen was in a cañon of the Tucson mountains in Southern Arizona. Halfway up the valley is a small mound of volcanic rock, perhaps 70 feet in height, and its western face, which is smooth and rises almost perpendicularly, is covered with carvings and drawings. They are chipped out of the stone to a depth of a quarter of an inch, but vary greatly in size. I have counted forty-six symbols,

of which the most common are those representing the human figure in various positions, animals of different kinds, and conventional signs of a geometrical pattern, whose significance is unknown. Judging from a careful study of these rocks, I am inclined to believe that they represent not so much the tribal records of these prehistoric people, but rather that their meaning was of a local, not of general interest—sign-posts, as it were, to indicate the whereabouts of water or game, the direction of a trail, or to convey a message. So that if they could be deciphered, it is unlikely that they would reveal to us any important clue either to the identity or habits of their makers. The Papago to-day, when questioned, deny all knowledge of them, merely stating that they believe them to be of supernatural origin—a common explanation given by uneducated and primitive people to things they do not understand. Whatever their importance, they formed no part of a general system, they became mainly conventional, and require for their elucidation a knowledge of the customs and habits of their makers which at present is largely wanting.

Before proceeding to describe the Seri Indians, I should like to express my indebtedness to Prof. McGee for many of the facts concerning their habits and numbers.

To the south of the Papago country, bordering the blue waters of the Gulf of California, are the Seri mountains, and a little further down the coast, separated by a narrow strip of water, is Tiburon island. The Seri Indians inhabit these two districts, the most savage and primitive race to-day on the North American continent. Incessant warfare and cruelty on the part of the Mexicans have driven them back into the most inhospitable and inaccessible parts of their arid and desolate country, and have rendered them most averse to and suspicious of any stranger. The study of this tribe is therefore beset with difficulties, but none the less interesting. The Seri Indians are physically a fine race, rather above the medium height, though somewhat slightly made. They are very dark, with long, coarse hair, but when young are by no means ugly. They have low, quiet voices, and their language is much more melodious than that of the Papago or Yuma Indians. Their clothing is somewhat unusual, for they wear a kind of robe of pelican skins over a short kilt or skirt. These pelican rugs are beautifully made of between four and eight skins sewn together with sinews of deerskin, and are used as bedding at night. Their belts are of woven human hair, or vegetable fibre, though snake and lizard skins are also used for the same purpose. The arms, bust, legs and feet are usually bare. When it is remembered that these people own no domestic animals of any kind, except dogs that are really coyotes, and do not cultivate or till the land at all, it will be seen that they have to depend entirely on hunting and fishing to supply them with dress and food. Pelicans are found literally by the thousand, especially round the little Isla Tassne, and provide the Indians with amply sufficient material to make all the clothing and rugs they are likely to need in that hot and almost rainless climate. As regards food, they subsist on turtles, fish, molluscs, and waterfowl, which are eaten raw; and during their respective seasons, they feed on the fruit of the various cacti, and on the mesquite beans, which grow fairly plentifully on the Seri mountains.

It is curious to note that the bisnaga, one of the most useful of the cacti, does not grow on Tiburon island; but this may be due to the improvidence of the natives.

Scattered over the greater portion of the island are charred oyster-shells, which shows that they are very partial to this form of food, and that they use fire to open shellfish, as they possess no knives. They catch turtles by harpooning them with a very primitive kind of spear; the latter is made of two parts, connected

by a fibre rope, to the front one of which a rough point of hardened wood, stone, or, if possible, iron, is attached. As soon as they see a turtle, they approach noiselessly from behind and thrust the spear through the shell. The front portion of the spear remains in the animal, but the turtle cannot escape because of the rope and it is soon towed to the shore and there broken open, when it is toasted or eaten raw. Fish, which abound in these waters, are caught by means of a fibre line and primitive hook, the latter being often made from a thorn or piece of bone, though sometimes the large fish are killed with a bow and arrow—a weapon much in use among the Seri. Their huts are of a most primitive description, being made merely of dried brushwood and roofed with turtle-shells and sponges. They afford some slight shelter from the sun, which is their main purpose, for the heat is always intense the year round, and the rainfall negligible. Their religion is exceedingly interesting, though little is known about it; however, the local character of their gods, and the absence of any traces of an ancient civilization, and of any evidence to show that any other race distinct either in habits or customs from its present inhabitants had ever made their home there, are convincing proof of their long residence in this locality, and it may be safely assumed, I think, that they are autocthonous. Like the Papago, they hold an important religious festival before starting out to gather the fruits of the cacti; and it is known that they bury their dead in their most elaborate garments, with their weapons beside them, under a mound of stones. These graves are to be seen all over the Seri country, and bear eloquent, if silent, testimony to the valiant defence they have made against their enemies; for of the several thousand Seri Indians known to exist some thirty years ago, there are about 375 left now, of which not more than 70 are adult males.

THE THERMAL REGIONS OF THE GLOBE.*

By A. J. HERBERTSON, M.A., Ph.D., Professor of Geography in the University of Oxford.

In the paper on the Thermal Regions of the World, of which I propose to present an abstract, there are a number of sections about which I shall say nothing, or next to nothing—for instance, the history of isothermal maps and the description of the different thermal regions. The reason for bringing the subject before this Department is to discuss the different methods in which the thermal conditions of the Earth's surface can best be represented for the use of geographers, and the different attempts I have made to do this, which I wish criticised. In what follows I assume that the temperature data are the most reliable available, and that the ordinary precautions have been taken in dealing with them.

If we start with the ordinary isothermal maps of the World, we have in Dr. Buchan's maps in the '*Challenger*' *Report* the one consistent set of maps which shows the distribution of temperature at sea-level for every month of the year. There have been newer maps showing the mean annual temperature, and also the mean temperature for July and January, but at the present time it would take many months to make maps more satisfactory than the *Challenger* ones for the different months of the year.

* Abstract of a paper presented at a meeting of the Research Department on Thursday, December 14, 1911.

The ordinary isothermal map contains many lines which, from the point of view of the study of physics of the atmosphere, are desirable and essential; but for most geographical purposes it is necessary to choose from them those which have the greatest geographical significance. For simplicity's sake I have chosen to deal at present with the lines of 0°, 10°, and 20° C. (32°, 50°, and 68° Fahr.). I have chosen 10° C. (50° Fahr.) because that line roughly represents the average temperature for the month during which growth becomes active for most plants of economic importance in temperate regions. I have chosen the 20° C. (68° Fahr.) because it marks roughly on the World the boundary between regions where sub-tropical products can mature and those where they cannot.

Taking those three isothermal lines it is possible from the ordinary isothermal map showing the mean annual temperature to make a map which shows temperature belts, but no map which merely shows the mean annual temperature is satisfactory. You are all familiar with the objections, which are obvious on examining Fig. 1. On the west coast in our latitudes the mean annual tempera-

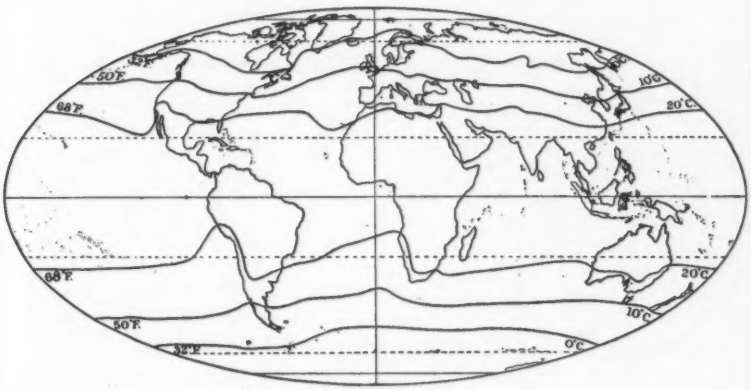


FIG. 1.—MEAN ANNUAL TEMPERATURE.

ture is the mean of temperatures which differ very little from it, whereas on the east coast the same mean annual temperature is found in a region with very much colder winters and hotter summers; consequently, some seasonal isothermal line must be introduced in any map which shows the thermal zones.

In Fig. 2 is a reproduction of Dr. Supan's map in which he combines mean annual isotherms and mean monthly isotherms taking the mean annual temperature of 20° C., and the temperature of 10° C. for the coldest month. I also have published maps showing the thermal zones using the lines of 0°, 10°, 20° C., for the warmest and for the coldest month (Fig. 3). This map is made by superposing the January and July isothermal maps showing the isotherms of 0°, 10°, 20° C. reduced to sea-level.

This is a very simple exercise, and any one who has to teach geography knows how valuable it is to make pupils take a tracing of those three lines from a January isothermal map and a tracing of them from a July map, and then to make a thermal zone map by superimposing the two.

Some important facts illustrated by this map may be noted. There is a wide belt of ocean extending beyond the tropics with an air temperature which

never falls below 20° (68° Fahr.). The belt narrows off the west coast of America, and widens off the east coast; it narrows off the west coast of Africa and widens again off the east coast of Africa. South and north of it are other belts which have summers with a temperature of over 20° C., but the winter's month is cooler than 20° C.

Two years ago I exhibited at the Research Department this and a number of other maps which had been constructed by similar graphic methods, to show mean seasonal temperatures, and from these seasonal maps a new one of the thermal zones. To obtain the seasonal isotherms, the three *Challenger* maps for December, January and February were taken—the isothermal lines of 0°, 10°, and 20° C. were drawn, and the three maps superposed. The mean position of each isothermal line was determined, and a seasonal map for the northern winter and the southern summer produced. Similarly, the other three seasonal maps were obtained. From the four seasonal isothermal maps a new map was drawn, showing thermal zones which had certain merits, which I do not propose to consider further in the present communication.

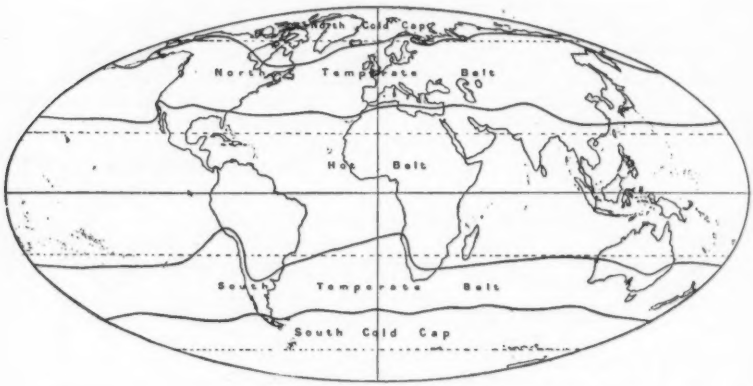


FIG. 2.—THERMAL BELTS.

All these maps were based on isotherms reduced to sea-level; but in all geographical work we find that the isotherms reduced to sea-level are insufficient. We want a map of the actual air-temperature conditions, and not what they would be if the surface were at sea-level. There are, however, many difficulties in the way of the construction of such maps. It is necessary to generalize the lines in order to obtain results which can be shown clearly on a small-scale map. It must be remembered that in drawing all small-scale maps it is necessary to make such generalizations, and that there is no particular reason why we should not attempt, in dealing with isothermal lines, the task which we always attempt in dealing with ordinary contour-lines. Accordingly a good many years ago I took the isothermal maps for January and July, drew them on contoured maps, calculated the actual temperatures from them, and then drew the lines of 0°, 10°, and 20° C. as they run across the actual surface of the continents. The maps of Figs. 4 and 5 are reproductions of the maps after they had been revised by two pupils, Miss Rogers and Miss Taylor. Miss Taylor not merely revised the lines

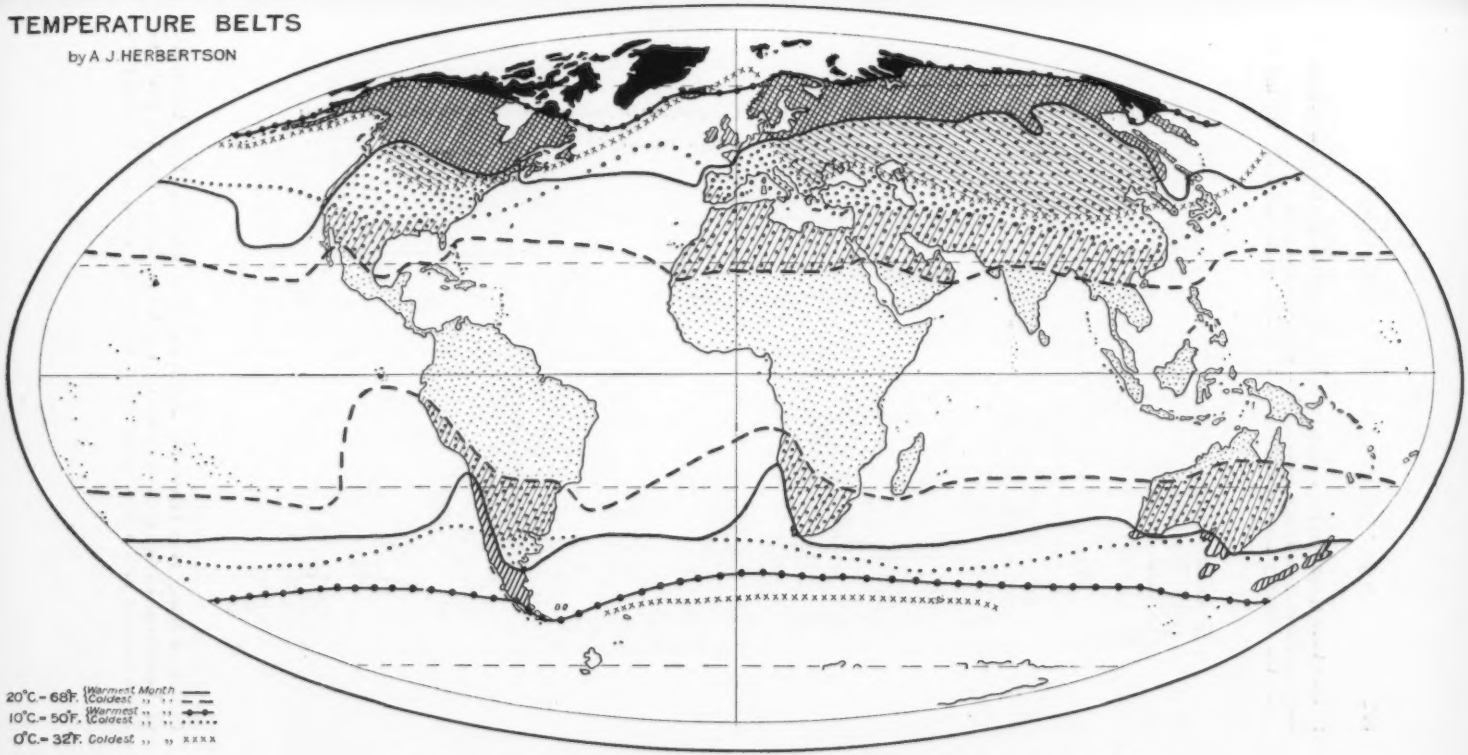


FIG. 3.—ISOTHERMS OF WARMEST AND COLDEST MONTHS CALCULATED FOR SEA-LEVEL.

as they were shown on the earlier map, but first redrew the reduced isothermal lines for January and July, taking recent data into account.

In the ordinary map of isothermal lines reduced to sea-level, the line of

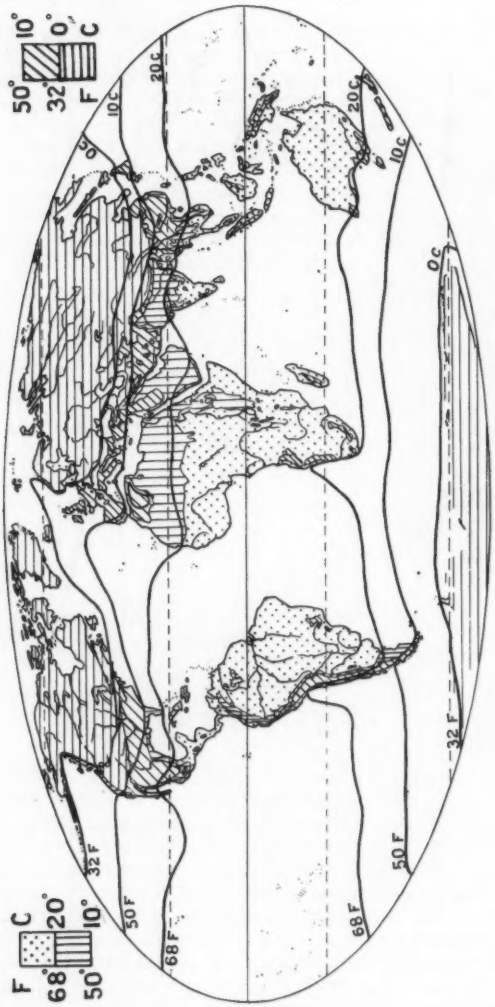


FIG. 4.—ACTUAL TEMPERATURES, JANUARY.

Over the lands the isotherms reduced to sea-level are continued as thick lines, and the actual temperatures are indicated by shading.

0° C. in January runs across the North American continent from the south of Vancouver island to the south of the Great Lakes, but the parts of North America with a mean temperature in January under the freezing-point

extend much farther south—as far south, in fact, as the isothermal line of 10° C. in the map of isotherms reduced to sea-level. In Asia the 0° C. isothermal line comes much farther south in Tibet than the line of 10° C. at sea-

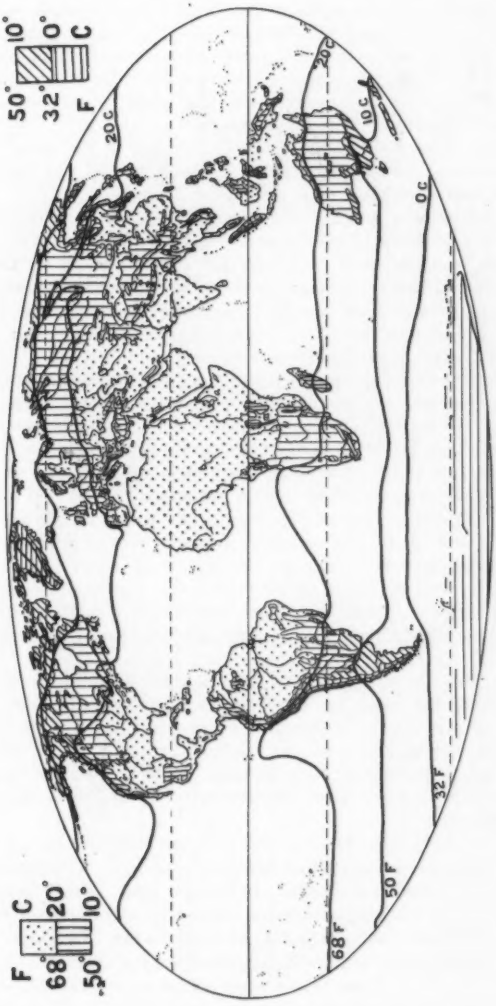


FIG. 5.—ACTUAL TEMPERATURES, JULY.

Over the lands the isotherms reduced to sea-level are continued as thick lines, and the actual temperatures are indicated by shading.

level. This is a very important matter, especially in dealing with the distribution of temperature in Asia. It is of value not merely to the geographer, but also to the meteorologist, for it has an important effect on the distribution of

pressure and winds. This difference between the two kinds of maps is perhaps even more noticeable in July. In Central Asia the region which has a mean temperature in July of over 20° C. is broken by the great mass of Tibet, and there is complete isolation between the high-temperature region of Northern India and the high-temperature region of the Tarim basin. The examination of no isothermal maps except those reduced to sea-level and the forgetting of the height of Tibet have given rise to some errors about monsoon winds current in ordinary text-books. When the isothermal lines are not reduced to sea-level, the low temperature of Tibet is very clearly shown and prevents any misconception about the action of Tibet on the Indian monsoon.

In the map of Thermal Regions of the World (Fig. 6) the lines of actual temperature drawn across the continents in the January map, and those drawn across the continents in the July map, have been superposed.

[In the map which was shown at the meeting the thermal regions of Fig. 6 were distinguished by means of colours, and it was pointed out that the colours of the map had been purposely chosen so that it was difficult to distinguish between the reds, and that for ordinary school use it was not important that the details indicated by tones of red should be noticed. For the higher classes of schools and for universities the careful examination of the differences of tones of various colours might profitably be undertaken.*]

This is a map of thermal regions; and not merely of thermal zones. The land surface on the whole is cooler than the maps of thermal zones suggest. For instance, in the ever-hot belt in Africa of Fig. 3, we find not merely a contraction of the belt, especially south of the equator, but an almost continuous north and south belt which runs along the East African plateau with a still cooler area over the equator. The belt of hot summers and cold winters in Fig. 6 is very much smaller than in Fig. 3 in the Old World, and is divided into a western region and an eastern region by a tongue of land with even colder winters and cooler summers which joins this belt of the north temperate zone to Tibet. This actual distribution of hot summers is of great economic importance, as for a number of plants the winter cold does not matter, especially if the plants are annual plants, and summer heat, not winter cold, determines their distribution.

It is not necessary to examine the details of this map more closely for the moment. While it has many advantages over the commoner thermal zones maps, it does not give all the information about temperature which it seemed to me might be expressed on a map of the World without undue complexity. Accordingly, I set about making thermal maps which would show the number of months with temperatures above 20°, above 10° C., and below the freezing-point at each station.

The graphic method used for sea-level isotherms for the seasons was first employed, and these maps were shown here two years ago. This method could have been used for actual temperatures, if monthly maps of real temperatures had been available. It was, however, much simpler to adopt another method.

Standard temperature tables were taken—those in the '*Challenger*' *Report*, in Dr. Hann's 'Klimatologie,' in the official publications of the United Kingdom, United States, etc. From these tables other tables were compiled, giving the number of months that the temperature was over 20°, over 10° C., and under

* This map, along with those of true January and July temperatures, is published on a sheet 60 × 40 inches by the Oxford University Press, price 8*s.* 6*d.* mounted on cloth.

0° C., and the numbers were inserted on large-scale maps. The height of each station was noted on another set of maps. Such maps should be made on tracing-paper to permit superposition. The line was now drawn separating

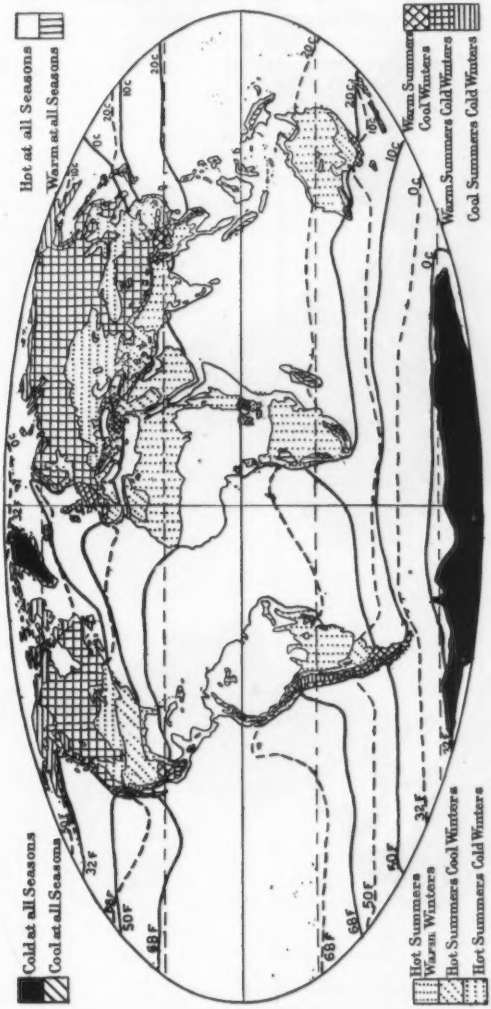

Hot at all Seasons
Warm at all Seasons
Cold at all Seasons
Cool at all Seasons
Warm Summers Cool Winters
Warm Summers Cold Winters
Cool Summers Cold Winters
Hot Summers Warm Winters
Hot Summers Cool Winters
Hot Summers Cold Winters

FIG. 6.—THE CHIEF THERMAL REGIONS OF THE WORLD, DISTINGUISHED OVER THE LANDS BY DIFFERENT RULINGS.

regions where one month of the year at least had a mean temperature of 10° C. from those where no month had such a temperature, and so on. In mountainous countries the valley or plateau conditions were considered, not those of the highest parts of the ranges. These lines are shown in the map of

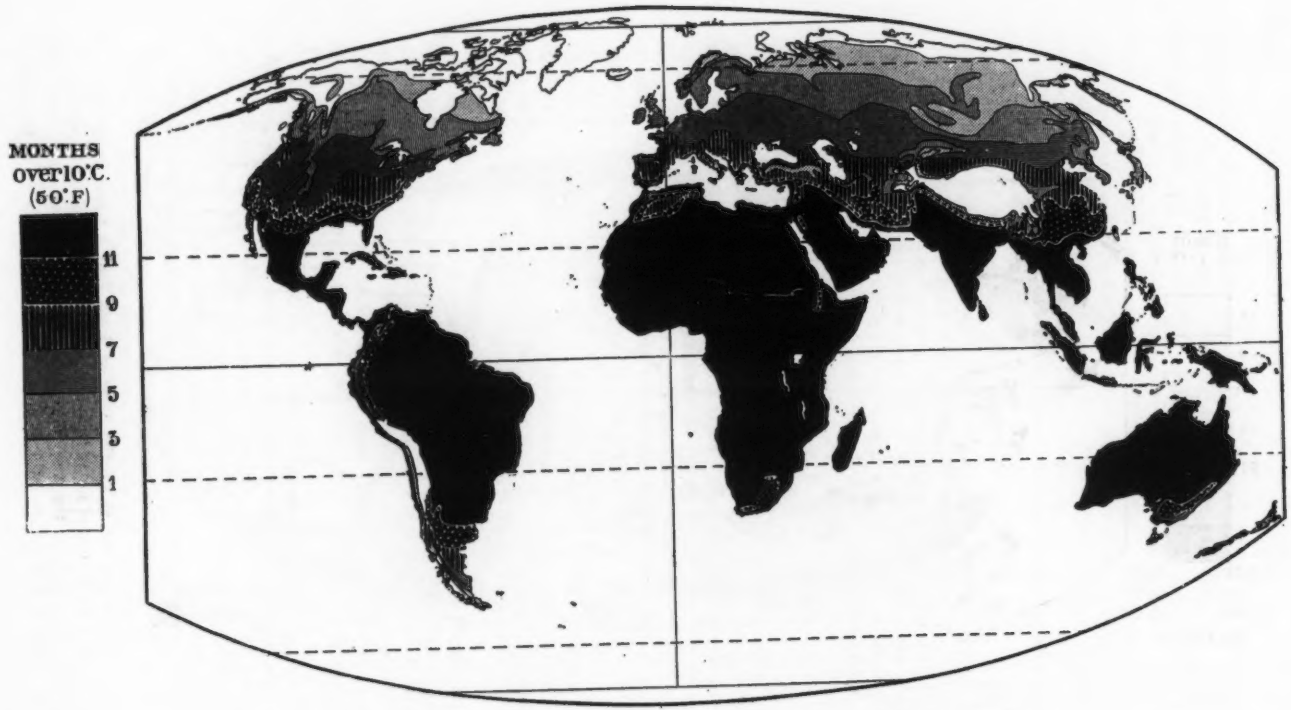


FIG. 7.—IN SOUTH AMERICA AND CENTRAL ASIA LAND OVER 4000 M. IS LEFT WHITE.

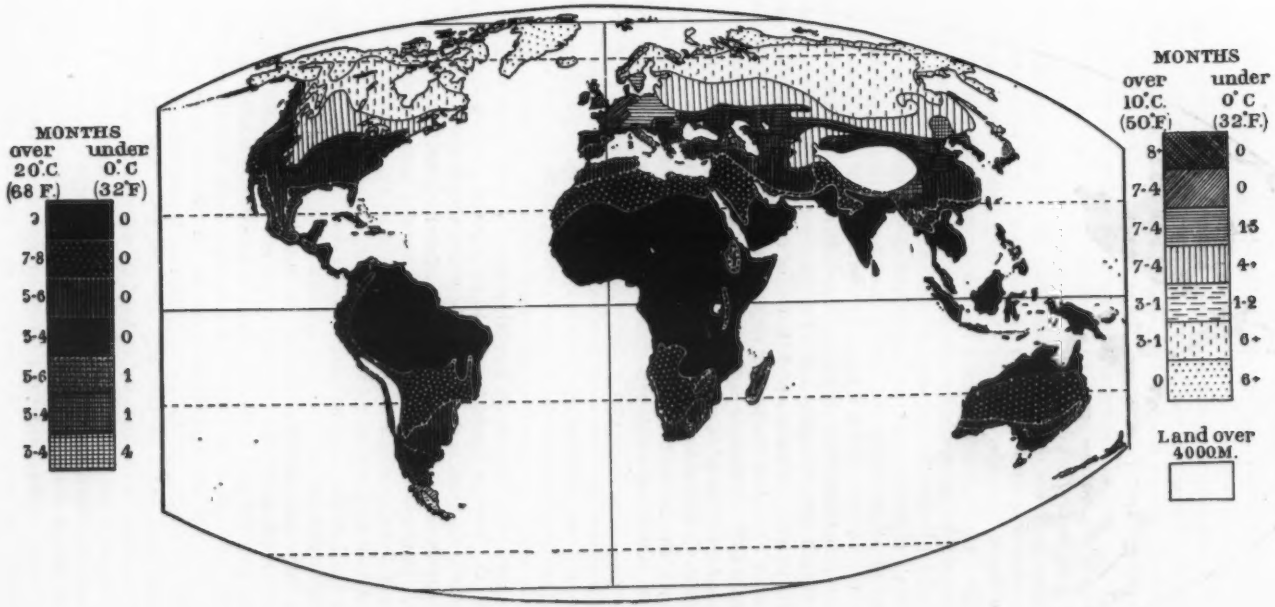


FIG. 8.—THERMAL REGIONS.

Fig. 7. The line between three and four months over 10° C. is rather important, as it indicates roughly the northern limit of profitable wheat growing, at any rate in the eastern half of North America.

Practically the whole of the inter-tropical land, with the exception of some of the higher parts of the Andes, have at least ten months of the year over 10° C.—that is to say, as far as temperature is concerned, growth would be continuous in these regions, and the periods of growing and resting depend not on temperature but on rainfall.

A map showing the number of months over 20° C. and another showing the number of months under 0° C. have been prepared. From these three maps the map of Fig. 8 has been constructed. In this map, in the north the dots indicate the region where no month in the year has a temperature of over 10° C., and that you will notice roughly coincides with the region of tundra. The areas with vertical broken lines are those in which at least one month in the year is over 10° C. In the southern part of this area at least three months in the year are over 10° C., but in winter at least six months in the year are under freezing-point. Consequently the soil is frozen for over six months throughout this region, yet for at least three months in the south and one month in the north a temperature sufficient for active growth is found. The region with continuous vertical lines has at least four months over 10° C., and it has also four or five months of frost. As we pass from the heart of the continents towards the west the number of months over 10° C. does not alter, but the number of months with frost diminishes. In Central Europe there are less than four months of frost, and in Western Europe there is no month with a mean temperature under the freezing-point. In the Far East, in the east of Korea and the extreme north of Japan, is a region which corresponds in this respect with Central Europe, but there is nothing in the east of Asia which corresponds with the British Isles, France, and the Low Countries in Europe. In Western North America, however, we find that milder region, as well as in the south of South America, in Tasmania, and in New Zealand.

In the next zone there is an area which still has from one to three frosty months, but here there are at least three months which have a temperature over 20° C. That in North America is roughly the northern limit of maize cultivation. South of it comes a belt in which, though frosts may occur, the mean temperature of the air is never under freezing-point for one month. In this belt there are at least five, and in the southern part of it there are six, months of the year with a mean temperature of 20° C. In the next belt there are from seven and eight months of the year with a temperature of over 20° C., and in the last there are at least nine months of the year with the mean temperature over 20° C.

This map, perhaps better than any other, shows the very great area of the land surface which has a mean temperature of over 20° C., the most favourable area for plant growth provided that the water-supply is adequate.

In the southern hemisphere, of course, those belts are represented in the reverse order, and are most clearly shown in Australia and in South America. In Africa the height modifies the simplicity of the arrangement and we get exceptional areas which are distinctly more temperate than any other part of this belt in similar latitudes in the southern hemisphere, except in the Andes.

In the case of the west coasts of the continent, we find the cool temperate conditions extending nearer the equator than they do in the Northern Hemisphere, and going farther north on the western than on the eastern side. It is not, however, necessary for me to analyse the relationship between coastal temperatures,

and prevailing winds and ocean currents. This is done in every text-book, and I am now more concerned with the discussion of methods than with the discussion in detail of the results.

There are difficulties in making a map of this kind, for a region such as Central Asia where the variations of height are very great. In a mountain region we cannot expect to show the actual surface temperature everywhere, as it varies from range to range in very short distances. It is convenient to block out the region over 4000 metres, which is roughly everywhere a region of constant snow and ice, and then in the marginal region around to select the temperatures of the opener valleys rather than those of the summits as a guide to the shading or colouring which should be employed. The disadvantages of using the temperatures of the lower parts would be neutralized if some special shading were used to indicate a mountainous region. For we must have some convention to represent the condition of a complicated mountain region, and this, perhaps, is the best; but I should like to have the opinion of others on this point.

In addition to the maps I have drawn a number of curves which show the seasonal distribution of temperature in these different thermal regions, and the gradual change in the range of temperature passing from west to east, the maximum range occurring within a comparatively short distance of the eastern margin of Asia, and occurring on the whole nearer the centre of North America. The different types of configuration, the north-to-south mountain barrier in America, the west-to-east barrier in Asia, and the gradual rise of the greater part of northern Asia towards the east, have their effect in throwing the line of greatest range of temperature more towards the centre in the case of North America, and more towards the east in Asia.

There is much work to be done in the more careful analysis of regions like British Columbia and the mountain belts of the United States, or of the Andes, or of Central Asia, for which the temperature figures at present are insufficient. But that can only be undertaken later, and on much larger scales than this map of the World. For the purposes of the World map the detail I have shown is probably as much as can be used with clearness.

Those are the main points of the paper which deals with two kinds of thermal region maps. One is made from the lines of warmest temperature and lowest temperature for the year; the other by counting the number of months above or under certain temperatures plotting them and drawing lines. The two maps show great resemblances, though they were made quite independently. One map brings out much more clearly the differences between the thermal value of the lands in the plains of North America and Asia than the other, this latter shows certain other points better. In making this new map Miss Evelyn Sandberg has aided me in supervising the whole of the tabulation done by Mr. H. N. Grant, and she plotted the figures on the maps, helped by Miss D. Forsaith in the case of North America.

Captain Lyons: Dr. Herbertson this afternoon has put before us a very interesting study in the matter of the graphical representation of data for geographical purposes, and I understand it is particularly with the view of discussing the most favourable method of such representation that he has brought the matter forward to-day. It is perfectly reasonable that the original data at the various points on the Earth's surface should be treated from the special point of view of the geographer, and that from that point of view certainly the actual temperature on the Earth's surface is of particular interest

to him. There are several here whom I am sure will wish to speak on the matter, so I will only refer to one or two points. I cannot say that I am attracted by some of those small and sharp indentations in the curves, especially in regions like Central Africa and South America and elsewhere, seeing that we are dealing with such very generalized phenomena, and that the maps themselves are on a small scale, I question whether it would not be better to round off these lines somewhat more generally. As regards the question of introducing the orographical detail to some extent, I think technically it would be rather difficult to do so satisfactorily where there is already so much colour detail on the maps, and in the end it might be preferable to work with a relief map alongside rather than try and include orographical data on the same one. In many cases the mountain range or the plateau is restricted in size, and to add such data from the cartographer's point of view may very easily produce some confusion. For the same reason I cannot say that I am very much enamoured of the proposal to use black for the high plateau and the highest mountain ranges.

Dr. D. T. Macdougal:—It seems rather an impertinence for one to discuss so serious a paper extemporaneously, but I would join with the chairman in suggesting that these sharp deflections of the boundaries of the thermal zones should be avoided as much as possible. Now so far as vegetation, and the activity of vegetation is to be taken as an index of a thing of this kind, the subject has a very special interest for me, but the longer I work with such things the less willing I am to speak about it. I would say, however, that we botanists are getting so that we are very much afraid to use average temperatures as a prime factor in determining the distribution of vegetation. To do so is impracticable because the activity and distribution of vegetation does not depend on average daily, monthly or annual temperatures. I can only say that our own work, so far as we have gone with it in dealing with the temperature factor and the activity of vegetation, is to use expressions indicating the hour degrees of exposure above any chosen zero of activity. This radical departure from the temperature summation of averages, proposed a century ago, has been found applicable in determining the beginning of seasonal activity, and the limits of distribution of plants. The two ideas are as different as the average steam pressure in a boiler and the curve made by a recording gauge. From another point of view, it is the maximum and minimum records that count rather than the averages, and vegetation is stopped or started by these extremes of temperature. Furthermore, the rate at which the temperature changes is also, I should say, a prime factor. To give a very common example, I presume every one in the room is familiar with the starting of bulbs; that to get your bulbs started in the spring the temperature curve must rise rather suddenly. I shall not use any more of your time, but this is a subject in which I am very vitally interested, and I realize very keenly indeed the danger of attempting to force too much detail on one engaged in so large a task.

Captain T. H. Tizard: My remarks would be almost entirely in concurrence with the late speaker. I certainly think it is not of very much use showing mean temperature areas, because they are not the temperature of sensation and they are not the temperature that is good for agriculture; because you show the same temperature over a desert as over a rainy district, but it does not grow anything. Similarly with our bodies; we do not feel the temperature of the dry but of the wet-bulb thermometer. The fact is we are all wet bulbs; we are constantly giving off perspiration, therefore the temperature of sensation is the temperature of the wet and not the dry bulb. Rain is a great factor in agriculture as well as heat. In places where no rain falls nothing grows, but

fortunately the rainy season in many places is in the summer-time and the rivers overflow, and consequently vegetation is ensured, but in places where no rain occurs in the hot season there is no vegetation. Another thing is in these maps the influence of the adjacent oceans is not shown. A reference was made to the coolness on the west coast of South America. A similar coolness exists on the north-west coast of Africa. This coolness arises from the wind blowing away the surface water, and its place being taken by the water from underneath, so that in some of the places, such as Callae, the temperature of the water is as low as 50°. For any practical purposes I do not think that the mere fact of showing temperatures alone, even if reduced down to the surface, is of much use either for vegetation or for sensation. I was unable to get a copy of this paper before it was read and did not know what it was going to be about; the thermal conditions of the world might mean the thermal conditions of the world underneath the surface, which is a subject well worth investigation, as at a certain distance under the surface the temperature remains the same at all seasons, but at what depth a given temperature is reached in any part of the world is uncertain. This subject is of value, as every town supplied with water requires to know how deep to put the pipes to prevent freezing.

Mr. W. Marriott: I have been very interested in what Dr. Herbertson has said. Isothermal maps are certainly of extreme value to meteorologists, and I do not know how we would get on very well without having the readings reduced to sea-level. Of course, that is the fundamental point in isothermal maps for meteorological purposes. The maps brought before us this evening are of great interest; they show rather the variability of the temperature in the various months, and that is of considerable importance. Of course, we know that over the land surface the range of temperature is much greater than it is over the sea, but that has not been the principle on which these maps have been compiled. The features, however, that have been brought out are likely to be very useful. Dr. Herbertson has done a great deal of work in the preparation of rainfall maps, and these temperature maps taken in conjunction with rainfall maps will be of great service in determining the climate suitable for the growth of crops in various parts of the world.

Captain Wilson Barker: My impression is that Dr. Herbertson's intention is to express meteorological conditions in a geographical manner. Meteorologists reduce all readings to sea-level, but I am of opinion that it might be better to reduce them to the mean level of the Earth's surface.

The subject is an interesting one, and thanks are due to Dr. Herbertson for bringing so interesting a paper before us.

Mr. J. Fairgrieve: I have tried myself, in teaching, to use these maps of Dr. Herbertson—the sheet that is already published—and I have given it up, much as I value the idea of true temperature. The fault I find with it is one of fundamental importance—that a class cannot see it. The lower maps for January and July are those that I should like to use—the upper is one that my pupils can construct from them. I should like to have the others larger, so that they could see and construct for themselves the region map.

Dr. Herbertson: May I begin with the last first and deal with the question of the use of the thermal map in teaching? The difficulty in distinguishing between certain tints is intentional. For ordinary teaching purposes in schools it is not necessary to differentiate between the various reds, or the various greens, but it is necessary to distinguish the reds from the greens. The colours were deliberately chosen so that the regions where differentiation was desirable stood out clearly in different colours, and the tints of each colour were used where

differentiation was not so essential. I have used the maps constantly in teaching, and have found that they have great advantages over the ordinary isothermal maps reduced to sea-level. I agree that it is an excellent exercise to make pupils construct such a map from them for January and July.

I do not mean to imply that these maps supersede the ordinary isothermal maps, even for geographers. Any one teaching geography scientifically must also use ordinary isothermal maps reduced to sea-level. These real thermal maps are a necessary preliminary study in the investigation I am carrying on of the qualities of the different Natural Regions of the World. In this investigation it is necessary to begin by analyzing the different elements which make up the very complicated characteristics of the different natural regions and see what the distribution of each is, and I have taken temperature first.

While bearing in mind the desirability of selecting for this purpose temperatures which have some meaning for botanists, I do not pretend that those thermal maps, more particularly the early ones, are maps which can be used as a key to the distribution of vegetation. Maps of cumulative temperatures would have better results, but until the data exist the nearest approach to them that we can attain for a map of the World on this scale is this map based on the duration of selected mean monthly temperatures. For certain parts of the World more may be possible, and I wish to make a thermal map of the British Isles, to indicate not merely the number of months, but the number of days of certain average temperatures if the data are sufficient. Undoubtedly, as Dr. MacDougal said, it is necessary to take into account maximum and minimum temperatures and rates of change of temperature, as well as the mean temperature, in discussing the relations between temperature and vegetation. I wish we could map wet-bulb temperatures, but wet-bulb temperatures are very difficult things to deal with. As far as I know, there are very few long-period observations of wet-bulb temperatures which are worth anything. The wet-bulb temperatures made in the ordinary Stevenson screen are practically worthless. You must use some form of ventilated instrument whenever the air is almost still, and as yet the data for a reliable map are lacking. The question of the maximum and minimum temperature is a little less difficult, and Dr. van Bebber's maps may profitably be used to supplement mine. Captain Lyons says truly that on a map of this scale too much nicety in the curve is not desirable; but the irregularities in South-East Asia, for instance, are diagrammatic and indicate that there are alternations of warmer valley and colder mountain, and so far I think they are justifiable. I do not know that there is anything else that I need say, but to thank all the speakers for their remarks.

Captain Lyons: There is no doubt that in the graphical representation of all data of this kind there are innumerable difficulties, and it is only by repeated discussion that we shall arrive at the best method of dealing with them. I am sure you will wish me to convey the thanks of the meeting to Dr. Herbertson for the opportunity he has given us this afternoon for discussing these matters.

A RECENT JOURNEY IN TRIPOLI AND CYRENAICA.

The following notes of a journey made in the spring of this year by M. Georges Rémond, correspondent of the French paper *L'Illustration*, are taken from issues of that paper, in which the journey has been described in full. It led along the whole length of the seaboard of Tripoli, from the Tunisian to the Egyptian

frontier, a stretch which, it is believed, has been covered in its entirety by no traveller since Barth (1846). The portion of the route along the shores of the Great Syrtis (Gulf of Sidra) had not been traversed by Europeans for many years, the last travellers to do so being, it appears, Rohlfs in 1879, and Freund in 1881.*

From Dehibat, on the frontier of Tunis, a difficult route leads to Nalut in Tripoli, following the foot of the hills by a stony track, and ascending by the boulder-strewn gorge of Melha, past cliffs violet or red in colour, to a pleasant country of gently undulating hills with abundant vegetation, principally of the tall grass called *dhis* by the Arabs. Nalut, where the Turkish officials gave the traveller a courteous reception, is a place of some 4000 inhabitants, most of whom were away at the war. It is mainly subterranean, the ksar or citadel lying in a deep valley, to the almost perpendicular side of which the houses cling, or are actually carved within it. In the setting sun the whole partook of a curious greenish-yellow tint, like that of sulphur, presenting a most fantastic appearance. The valley widens out below and forms a prosperous oasis. Between Nalut and Juch the party traversed for two and a half days a lifeless desert plain, bordered on the west by the low hills of the Jebel Nalut, Nalut with its *kasr* standing out in the rear like a gigantic ruin. Camping at night in the Wadi Ghilah, the travellers experienced a violent storm of wind and rain, which caused a sudden flood and drove them from the shelter of the wadi. At a small oasis nomads were seen with flocks of goats, but no supplies could be obtained from them. Juch, reached on January 21, is a small oasis with a sordid collection of some sixty to eighty houses, part empty and part in ruins, with two small fortified towers. Three hours beyond are the springs of Ain Ghazal (the spring of the Gazelle), and the next day found the travellers at Chekchuk, a small but fertile oasis, with dense groups of palms and a small fountain, making a deep green patch in the brown desert. Reaching the bold spurs of the Fessato hills, the route follows a wadi among large boulders. On all the accessible slopes of the hills the inhabitants have formed terraces, rising in tiers, with supporting walls of stone and embankments to retain the water. Here they plant small gardens of vegetables or of wheat. A few villages, encircled by enormous olive trees, cling to the hillsides, and winding paths lead to the summits, while foaming cascades tumble among the palm trees. A precipitous path, difficult for laden beasts, leads to Jado, the seat of the kaimakam of Fessato, its half-ruined houses scattered over a rocky plateau, round a *kasr* as centre.

Leaving Jado, the track follows the crest, and the country becomes less forbidding. Groups of palms and olive trees occupy the hollows, and the abundant pasturage was dotted at the time with violets and jonquils. Zintan, five hours from Jado, is a large village of troglodytes, while Ain Rumia, passed the next day, is a delightful spot, its orchards carpeted with flowers. A little beyond is Iffren, a Turkish military post, with several small villages in its neighbourhood hidden in beautiful valleys. The country still bore the sulphur-green tint before observed, the dark clumps of trees standing out like the pattern of a carpet. Through an opening to the north could be seen the fertile plain of Kattis, which extends to the coast and is known as the granary of Tripoli. Iffren, whose warlike inhabitants, descended from Syrian emigrants, offered a desperate resistance to the Turkish conquest, is the centre of a *sanjak* or prefecture, with the subdistricts of Nalut, Ghadames, and Fessato, to which have been recently

* For Freund's journey see *L'Esploratore*, Milan, 1883.

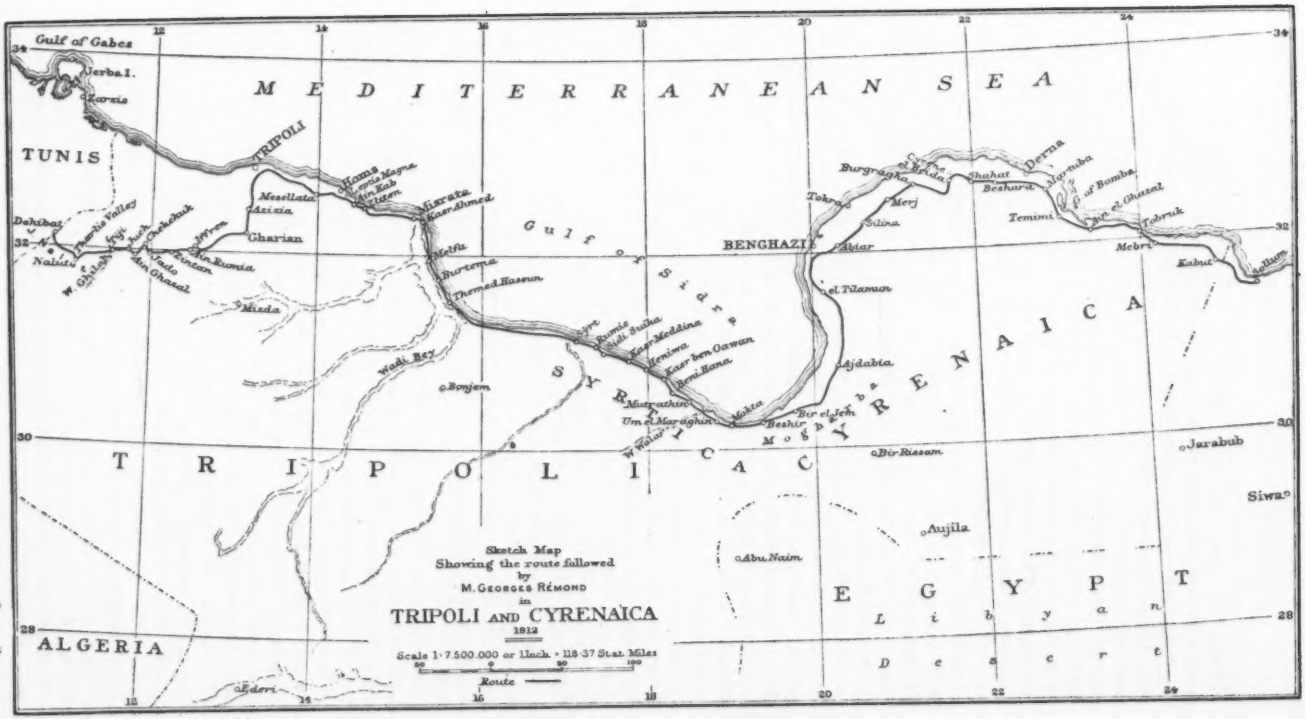
added those of Zuara and Juch. The inhabitants of the district number 60,000, divided between the orthodox Moslems and the schismatic Nefusis.

At Kosbath, camp was formed among deserted houses, many of them grottoes or caves entered by low doors. The olive trees now ceased, and a more sterile country was entered, producing little but *dhis* eaten by the camels, with aromatic tufts of *zahater* (mint), greedily eaten by the traveller's horse. On February 1, as the caravan wended its way in a biting wind past the ruined castles of Sbea and Haji Omar, the outlook improved, and the aspect of the country recalled that of Provence or Tuscany. Near Gharian, the well-known troglodyte villages had the appearance of great mole-hills. A closer inspection revealed a kind of deep well, either circular or rectangular, forming the common courtyard of several subterranean houses. The main gate was a monumental erection of two arcades, from which a vaulted passage gave access to the living-rooms, granaries, and stables. Gharian comprises in all some 20,000 inhabitants, but little is visible externally except a few huts round a central market, and the *kasr* or citadel.

After visiting the Turkish outposts at Tripoli and striking eastwards to the lines at Homs, M. Rémond reached Mesellata on March 1, finding here a delightful country with numerous villages. Mesellata has a considerable market and some stone houses, while outside is the old citadel almost in ruins. Proceeding towards Zliten, the track descends from a plateau of about 820 feet altitude to the sea coast at Sahel, whose endless lines of Roman columns are probably part of the ruins of Leptis Magna. For a time the journey was monotonous, among sandy undulations within sight and hearing of the sea, but near Zliten palm-groves reappear. This place, with its stone-built houses and small public garden, lies 2 miles from the coast, which is here a mass of dunes. It contains the tomb and mosque of the much-invoked prophet Sidi Abd-es-Selam. Misrata, ten hours beyond, has wide streets and quite a modern air, with houses of officials, corn market, etc. It is some 2½ miles from the sea, and its port is at Kasr Ahmed or Busheifa, some 8 miles to the east. The oasis is of considerable size, and contains 60,000 to 70,000 inhabitants.

From Misrata to Benghazi along the shores of the great Syrtis it is a long and difficult route, with water and supplies at a few points only. An immense extent of sand-dunes, supporting only a few thorny bushes, extended inland, appearing a beautiful mauve colour under the rising sun. In this great void the small caravan seemed lost in a lifeless world, presenting only an interminable line of telegraph poles. Skirting some wide marshes to the south, the party reached Burtema, a small telegraph post in the desert. At Themed Hassun another such post was passed, lying in a small green expanse with a well of sweet water. Immense sandy plains stretched far into the interior covered with crystals which glittered like diamonds. An expanse of stagnant water proved to be the mouth of the Wadi Bey, which there loses itself in the sand. Passing the tomb of Manhola, a guilty daughter who had slain her father, the escort, after the arab custom, discharged their pistols and rifles at it. On the 16th the caravan became enveloped in a thick sandstorm raised by the *gebli* or south wind, the plague of Tripoli. After plodding through this for nine hours, it came in sight of Syrt. The modern Syrt has existed for only four years, the *kasr* alone having been standing for eighteen, while all the ancient ruins have been buried by the advancing dunes. The kaimakam, Mohammed Bash Agha, was one of the hereditary tribal chiefs of Misrata.

Continuing along the coast, the route left the sand-dunes late on the 21st and entered an undulating country with pasturage and scattered flocks. At the


Gulf of Gabes
Jerba I.
Zarzis
MEDITERRANEAN SEA
TUNIS
TRIPOLI
Homs
Misellata
Azizia
Gharian
Kasr Ahmed
Gulf of Sidra
Dahibat
Nalut
Mizda
Bir Rumia
Bir Rumis
Sidi Sulia
Kasr Meddina
Henina
Kasr ben Gawan
Beni Rena
Wadi Bey
Bonjem
Murrathin
Um el Maraghni
Wadi
Mokta
Bir el Jeh
Beshir
Mogabba
BENGHAZI
Tokra
Merj
Solina
Agdabia
el Tilamun
Burgdagha
Shahat
Derna
Beshara
Temimi
Tobruk
Mebruk
Kabut
Bardia
Gulf of Bomba
Gasr el Ghazal
CYRENAICA
TRIPOLITANIA
Bir Rissam
Jarabub
Siwa
Aujila
Abu Naim
EGYPT
Libyan Desert
ALGERIA
Ederi
Sketch Map
Showing the route followed
by
M. GEORGES RÉMOND
in
TRIPOLI AND CYRENAICA
1912
Scale 1:7,500,000 or 1 Inch = 118·37 Stat. Miles
Route
12
14
16
18
20
22
24
34
32
30
28

telegraph post of Kasr Meddina, with slightly brackish water, palms, fig trees, and fields of barley were seen, and, at the small *dwar* of Heniwa, a nomad Arab camp. Wells of indifferent water now became more frequent. The way continued monotonous, and large sand-dunes were again seen, a well amongst them being so brackish that the animals refused to drink. On the 28th the boundary between Tripoli and Cyrenaica was passed at Mokta, and next day a *dwar* of the Wuld Mogharba, a large Arab tribe occupying this part of the coast. At Beshir, abundant sweet water is found near the surface, and among the dunes there are small gardens of tomatoes cultivated by the Arabs, as well as groups of palms and fig trees, but these are half buried in the moving sands. Telegraph posts continued to be passed at intervals of about 60 miles, and on April 1 Ajdabia, the first town of Cyrenaica, was reached. Formerly an important place, it became covered with desert sand, but has lately renewed its life to some extent through the energy of its kaimakam. A few miles before this the sandy desert ceases, and the place lies on a stony plateau with abundant water at 10 feet depth. The many disused wells testify to its former activity, and Roman inscriptions can still be faintly traced. A few modern houses have been built, and there is a large market used by the nomad Arab tribes, who trade in cattle and barley. It is also a halting-place for caravans bound for Benghazi, and from it M. Rémond pushed on to the Turkish camp outside that place. At this time the principal Senussi leader, Sidi Ahmed esh Sherif, was daily expected from Kufra, but he had still not arrived two months later. All Cyrenaica is Senussist, and the *zawias* or seats of the various brotherhoods recall the monasteries or hostels of the Middle Ages. They are often built from the material of an adjacent ruin, are situated near a well, and serve as places at which every traveller can demand hospitality. A *fiki* (teacher) instructs the members of the *zawia* in the tenets of the cult. The sheikhs are nominated by the chief Senussi in Kufra, though the succession is in general hereditary. The largest *zawia* of Cyrenaica is that of El Tilamun, some eight hours south-east of Benghazi. The name of Mohammed el Mahdi, son of the founder of the sect, is still well remembered in the country. Moving from Jarabub to Kufra in 1900, he subsequently retired still further to the oasis of Kiru, where he died in 1902, being succeeded by his nephew, Sidi Ahmed esh Sherif, now about forty years old, who will probably be succeeded by Sidi Mohammed Idris, eldest son of El Mahdi.

Starting eastward from Benghazi on April 17, M. Rémond passed through chains of hills, on one of which, known as Silira, is an old acropolis with other ruins. The landscape, with its groups of pines (*Pinus maritimus*) and stretches of green grass, resembled a wide park, and partridges, blue pigeons, doves, and a few hares were seen. In a wide fertile plain stands the small stone-built town of Merj, with an old *kasr* in its centre and abundance of fruit and vegetables in its gardens. At Ghariab, camp was pitched under the shade of magnificent olives, near a copious well of sweet water. Traces of ancient ruins were seen on many of the summits, on one of which, giving a wide outlook, stands the tomb of Sidi Abdulla. At Magdein an exceptionally fine ruin, including a castle with stone towers and solid walls 50 feet high, was passed. The descent hence into the deep valley of Wadi Karaib, with its rocky precipices and great pines and cedars, recalled the gorge of Gondo on the descent of the Simplon towards Domodossola, though with a wilder and harsher note. Ruins continued to be seen, and an ancient paved road still bore the marks of Roman chariots, while tombs extended along it for several miles.

On April 22—a day of rain—the route lay across an undulating plateau

with pasturage, ruins, and many camps of nomads, recalling the Roman campagna. Among some large pines was a monument to Sidi Rafa, the general of the Arab conqueror Abd er Rahman. Approaching the ancient Cyrene, the ruins increased in numbers and importance, though not remarkable for style. The plateau ends in a narrow valley watered by a copious stream, and cultivated by some Cretan emigrants. The valley descends abruptly to a lower plateau, covered with ruins, tombs, and cisterns, the whole apparently having been a great cemetery for the surrounding towns. On the 23rd an ancient paved track, crossing the higher plateau, again showed the old ruts of chariot wheels. Having reached the Turkish camp outside Derna, and, after many delays, collected camels for the further journey, M. Rémond started again on May 11. In the Wadi Derna a small stream was flowing, bordered with Oleanders and a few trees, and another was found at the oasis of Martuba, which, with its palm-groves, fig trees, and grassy meadow grazed by cattle, made a dark green patch in a bare desert. Desolate stony plateaux were crossed on the 12th, and a view of the Gulf of Bomba was gained. At Temimi the travellers found a small spring of good water, besides a brackish well, but at Ain-el-Ghazal, at the head of a deep bay, there was only a brackish supply. On the 14th the Turkish camp before Marsa Tobruk was reached. Here the picture was one of glaring sun, dust, flies, and a bare desert stretching to the horizon, though the heat is tempered at times by a strong sea breeze. During the next stages disputes arose with the Arabs as to the use of the wells, and payment had to be made for the water. On the 18th a torrid southerly wind brought the heat of a furnace, and caused strange mirage effects. The next day a start was made at 2 a.m. from the wells of Kabut, the route being bounded to the south by a line of low stony hills. Cisterns, now dry, showed that in former days this desert was cultivated. At last, on May 20, the caravan reached the camp of the sultan's troops opposite the *kasr* of Sollum, occupied by Anglo-Egyptian troops, where M. Rémond was received by the British officers in charge. Hence Alexandria was reached by the coast-guard steamer.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

By E. A. REEVES.

It is clear, from the keen interest shown in the subject and the good attendance at the recent meetings of the section, that geography continues to maintain the prominent position it has always occupied at the British Association. Whether it was due to the fact that Dundee has in the past taken such an important part in Polar exploration, to the unusually large attendance at the meeting this year, or because the programme was an exceptionally attractive one, it was gratifying to notice that the attendance at the geographical section was, as a rule, larger than has often been the case in recent years; and on at least one occasion the lecture hall allotted to the section, by no means a small one, would not seat nearly all who wished to attend. This was at the discussion on Antarctic exploration; but an unusually full attendance was then to be expected, as Sir Clements Markham, Dr. Bruce, and others who took a leading part in the discussion are so well known that the fact that their names were down as the leading speakers was sufficient in itself to draw a large company together, particularly at Dundee, where the *Discovery*, the ship of Captain Scott's first expedition, was built, and whence so many whalers and other vessels have started on voyages of discovery to the Polar regions. There were, in fact, several of these in the dock at Dundee at the time of the meeting, notably the *Morning*, the relief ship sent to the aid of Captain Scott when the *Discovery* was

frozen in the ice, and the old Antarctic whalers *Balæna* and *Diana*, which have both done excellent work in their time, but which now seem to have finished their honourable and useful careers. As was doubtless natural, the other papers which drew the greatest audiences were those of a more or less popular nature, where there were plenty of lantern pictures and not much, or at least not too much, science. It would be encouraging to see a keener interest in scientific geography, especially as the British Association is avowedly for the advancement of science.

The section was accommodated in the building of the Young Men's Christian Association, and everything was done by the local authorities to suit the convenience and comfort of those attending the meetings. The president of the section was Colonel Sir Charles M. Watson, K.C.M.G., C.B., M.A., R.E., while those who supported him as vice-presidents were Dr. Tempest Anderson, Mr. R. B. Don, M.A., Colonel H. W. Feilden, C.B., Colonel Sir D. A. Johnston, K.C.M.G., Dr. J. Scott Keltie, and Sir Clements Markham. K.C.B., F.R.S. The secretaries were Rev. W. J. Barton, M.A. (Recorder), and Messrs. J. McFarlane, M.A., E. A. Reeves, F.R.A.S., and D. Wylie; while among the names of those who served on the committee were to be found those of Dr. H. M. Ami, Mr. J. Bolton, Dr. R. N. Rudmose Brown, Dr. W. S. Bruce, Mr. H. T. Burls, F.G.S., Sir George Fordham, Mr. Harding King, Captain E. O. Henrici, R.E., Prof. J. Milne, Prof. J. L. Myres, and several others equally interested in geography. All worked together with the greatest harmony, and did everything in their power to make the meetings a success.

It would have been difficult to find a more suitable president than Sir Chas. Watson, who has devoted the greater part of his lifetime to geography and kindred branches of knowledge, and who, in his younger days, served under General Gordon in the Sudan, and did much to extend our then very limited knowledge of those remote regions. As the result of his early surveys, he, with Lieut. (now Colonel) Chippendall, prepared the first map of the White Nile that was at all reliable, and this was published in the *Journal* of the Royal Geographical Society for 1876, vol. 46. Since that time, as is well known, he has done much to promote geographical science, besides taking a leading part in archæological matters, especially in connection with the excellent work of the Palestine Exploration Fund.

It was quite fitting that the greater part of Sir Chas. Watson's presidential address, which was delivered on the morning of Thursday, September 5, and was published in the October number of the *Geographical Journal*, should be occupied with the Sudan, with which country he has had such a long acquaintance.

After the president's address the reading of papers was commenced, and as the International Map of the World had been referred to in this address, it was natural that the short paper upon this map, by Colonel C. F. Close, C.M.G., R.E., the present Director-General of the Ordnance Survey, who has taken a leading part in its preparation in this country, should be read first. In the absence of Colonel Close, this paper was read by Captain E. O. Henrici, R.E., of the Ordnance Survey Office, who supplemented it by a few remarks of his own. After referring briefly to the meeting of the committee of representatives of the various European and other nations, which met in London in November, 1909, to draw up a definite scheme for the construction of the map, this paper dealt with other points of interests in connection with it, such as the colour tints for heights, accuracy of the projections, as computed by M. Ch. Lallemand (see *Geographical Journal*, May, 1912), and finally gave clearly the present position as regards the sheets to be published and the number that will be required to complete the map. The total number for the whole world, including oceans, is 2,084, or omitting water areas, 500 sheets will be necessary to include all the lands. Not including a certain number of preliminary sheets that have been issued in the United States, only five of these sheets have so far been

published, four of which were prepared in this country and one in France. After the reading of Colonel Close's paper, an interesting discussion followed in which Colonel Sir D. A. Johnston, Mr. J. Bolton, and Mr. E. A. Reeves took part. Certain features of the map were criticized, and technical matters connected with its construction dealt with, such as the advisability of continuing the "layer" system of representing heights, and the issuing of an uncoloured as well as a coloured edition of the map.

The next paper was one by Mr. E. A. Reeves, on new and improved instruments and apparatus for geographical surveying. In this were briefly described recent experiments in the determination of longitude by wireless telegraphy, the astrolabe à prisme, watches for astronomical observations, including those with the Guillaume balance, various forms of theodolites, the Zeiss and other reflecting levels, recent progress in photographic surveying, and several other important subjects. A novelty which excited considerable interest was Mr. Reeves' new night-marching watch (made by Castella), which consists of a simple arrangement fitted to an ordinary watch to enable a traveller to march on any desired bearing by stars at night. At the end of this paper was described and exhibited a set of cheap instruments, constructed under the direction of Mr. Reeves by Messrs. G. Philip & Son, for teaching the principles of geographical surveying in schools. This paper will be published in full later on in the *Geographical Journal*.

A lecture by Dr. H. M. Ami on some of the less-known parts of Canada, where recent survey work has been carried on, brought this first morning's meeting to a close. Some of the lantern slides shown by the lecturer were of exceptional merit.

The next morning, Friday, the Geographical Section met at ten o'clock, and the first paper to be read was one by Sir H. G. Fordham, entitled "Notes on British and Irish Itineraries and Road Books." The author is, of course, well known on account of the work he has done in connection with British cartography, and at the Dublin meeting of the British Association in 1908 gave an interesting lecture on early maps and atlases of this country. A valuable collection of road books, brought together by Sir Herbert Fordham, was exhibited in the lecture hall. The paper dwelt specially on the value and interest of itineraries and road-books in relation to both geography and bibliography, and traced their development and characteristics from the first publication of such works in the British Isles, late in the sixteenth century, until the advent of the railway system put an end in the middle of the nineteenth century, for the time at all events, to this species of literature.

Dr. F. Oswald, whose geological researches in Armenia in connection with Mr. H. F. B. Lynch's expedition are well known, has recently visited an unexplored region, the Kisii highlands to the north-east of Victoria Nyanza, and in the next paper gave a description of his journey, illustrated by an excellent set of lantern views, and maps from his own surveys. He will probably give a more complete lecture to this Society on the same expedition during the coming session, and his account, with the surveys, will afterwards be published in the *Geographical Journal*. Two other papers, one by Mr. G. W. Grabham, of the Sudan Political Service, on the country north of Lake Albert; and the other by Mr. H. M. Cadell, on river development in central Scotland, both illustrated by lantern views, finished this morning's sitting. The former of those described the imperfectly mapped region west of the Nile, from Dufle and Lado to the Belgian Congo boundary, and the experiences of the author with the natives, and his description of the country were listened to with great interest. Mr. H. M. Cadell is a geologist who has done much useful work, specially in Scotland, and what he had to say about the past history of the Scottish river systems and their geological development was most instructive. His remarks on the development of the Tay basin were much appreciated, perhaps

chiefly on account of its local interest. One important feature in the lecture was the tracing of the Tay Bridge disaster, in a certain measure, to the lack of proper geological knowledge on the part of its constructors of the Tay basin, and the submerged river-bed.

In the afternoon of this day, Mr. A. H. Garstang gave a popular lantern lecture, entitled "Some Canyons of the Cevennes," in which he described a recent visit paid to this remarkable district of France.

After the usual week-end excursions, the Geographical Section assembled at ten a.m., on Monday, September 9. The audience was unusually large, even at this somewhat early hour, doubtless in anticipation of the discussion on Antarctic exploration, which had been advertised to take place. However, before this commenced there was a paper of another character to be read, and this was one by Mr. E. A. Martin, F.G.S., on "Dew Ponds and Mist Ponds," a subject upon which he has on two previous occasions addressed the Research Department of this Society (see *Geographical Journal*, August, 1909, and October, 1910).

The Antarctic discussion started immediately Mr. Martin had finished his paper, about 10.45, and continued to 1 o'clock. It was introduced by Sir Clements Markham, who was most cordially received. A full report of this discussion will be published in the *Geographical Journal*.

In the afternoon of this day a lecture was delivered by Mr. P. A. Talbot, entitled "Some Experiences of Southern Nigeria," which dealt with the character of the country, but more especially with the natives, their customs and traditions. The lecturer, who is an official resident in the country, is well known in connection with the good geographical and anthropological work he has done in the past in this part of Africa, and many will doubtless remember the interesting lecture he gave a few years ago before this Society.

On Tuesday, September 10, the Geographical Section met for the last time. The papers read in the morning were on the Sonora Desert of Mexico, by Mr. I. N. Dracopoli; the Libyan Desert and Ennedi, by Mr. W. J. Harding King; The Submarine Canyon of the Hudson River, by Dr. J. W. Spencer; Some Effects of Climatic Pulsation in a Highland Region, by Prof. J. L. Myres; and Geographical Education in Scottish Schools, by Mr. T. S. Muir. Most of these were illustrated by lantern views, and those that are considered of sufficient interest will doubtless be published in full later on.

Mr. Dracopoli is a most promising young traveller, who has done some excellent surveying work, after receiving instruction at the Society under Mr. Reeves. He has been able to extend the United States triangulation into Mexico, and to accurately determined positions has filled in the topography with a plane-table. Mr. Harding King, who has also received instruction in surveying at the Society, is well known as an explorer in the Sahara, and has recently made two important journeys in the Libyan desert, in the neighbourhood of the Dakhleh and other oases. He has come upon the remains of old Roman roads, and has obtained much useful information concerning courses of wadis and caravan tracks from his own observations and reports of Arabs. A map with a paper of the earlier part of this work was published in the *Geographical Journal* for February, 1911, and another giving the results of his more recent investigations is now being prepared.

Prof. Myres did not speak for long, but described briefly the provisional results he has arrived at in connection with the changes of climate in Asia Minor, Armenia, Greece, and the East generally, and the consequent effects of these changes on migration and habitat of the peoples. He is studying this subject further, and later on hopes to publish something upon it. Reference was made to Mr. Ellsworth

Huntington's work in Western Asia, and to his paper on the "Burial of Olympia," published in the *Geographical Journal*, December, 1910.

A very important subject was dealt with by Mr. T. S. Muir, M.A., in the short paper he read on the position of geography in Scottish schools. In this it was pointed out that while the old method of teaching geography is dying out in Scotland, the new method is meeting with serious obstacles. The teaching of geography after the elementary stage is largely controlled by the Intermediate and Leaving Certificate examinations. In the Intermediate stage geography forms part of the English paper, and is compulsory; in the Post-Intermediate stage it is separated from English, and is optional. The result in the latter case is that geography either forms no part or only a very small part of the education of a pupil over fifteen years of age. Mr. Muir considers, and apparently very rightly, that geography should be made compulsory throughout the whole of the school course.

In the afternoon of this closing day Sir William Willcocks, K.C.M.G., gave a lecture on Canada, and Prof. C. Hedley, of Australia, gave a clear description, and showed some striking slides, beautifully coloured, of the Great Barrier Reef. Sir William Willcocks, whose name is so widely known in connection with irrigation works in the East, has lately visited Canada to investigate on the spot the farming possibilities, specially where irrigation has been carried on. As might be expected, many facilities not accorded to ordinary travellers were placed at his disposal, and he evidently made a thorough study of the country and its prospects so far as his time permitted. His humorous address was full of up-to-date information and salutary warnings that should be of the greatest value to any one thinking of settling in Canada, but specially to young men with a little money who are thinking of starting farming there. Sir William thinks of publishing his paper in some suitable journal, and it is to be hoped that he will do so.

ANTARCTIC DISCOVERY AT THE BRITISH ASSOCIATION.

At the Dundee meeting of the British Association, the morning of September 9 was devoted to the subject of the "Present Position of Antarctic Discovery." It was opened by a paper by Sir Clements R. Markham, K.C.B., F.R.S., which dealt mainly with the exploration of the Antarctic continent.

Sir Clements Markham spoke as follows:—

I have been asked to put before the Section the present position of Antarctic discovery. It must be understood that our object, when I commenced my advocacy of the renewal of Antarctic work in 1893, was the exploration of the Antarctic continental land. My action in advocating the despatch of an expedition with that object was followed by seven or eight enterprises, undertaken by six different countries, but these were not directed to the object which I advocate, namely, the exploration of the Antarctic continental land. They achieved valuable scientific results which I fully appreciate.

Sir John Murray, who at my request opened the Antarctic campaign in a paper read before the Royal Geographical Society on November 27, 1893, admirably defined our objects. "A dash to the South Pole was not what he advocated." It is also outside my sphere of advocacy. Our objects, as Sir John Murray defined them, were:—

1. To determine the nature and extent of the Antarctic continent.

2. To penetrate into the interior.
3. To ascertain the nature and depth of the ice-cap.
4. To observe the character of the underlying rocks and the fossils.
5. To take magnetic and meteorological observations both at sea and on land.
6. To observe the temperature of the ocean at all depths.
7. To take pendulum observations.
8. To sound, trawl, and dredge.

All these should be the work of a modern Antarctic expedition—and these were our objects: not outside but well within the Antarctic circle. The first step was to decide upon the best route. We took stock of what we then knew.

Captain Cook was the first to cross the Antarctic circle and reached 71° 10′ S. in 1773. He was followed by the Russian expedition under Bellingshausen in 1821, who sighted Alexander island and Peter island in 69° S. Both sailed round the world on or near the Antarctic circle. But their results were negative as regards an Antarctic continent. It was the voyages of Biscoe, Balleny, Dumont d'Urville, and Wilkes which reported indications of high land on the Antarctic circle or near it, along the meridians of Australia and Africa.

But on the American side the land had been found to be far to the south. Biscoe had discovered Graham land, a long peninsula or island extending far to the north of the Antarctic circle, but in 1823 Weddell in 34° 16′ W. sailed as far south as 74° 15′ S. No one had been further south in that direction until the dispatch of Filchner's expedition of which we have great hopes. Finally, the expedition of Sir James Ross did real work. With his two sailing ships he put their bows right into the pack and forced his way through, thereby sighting a range of high land extending to 78° S., and two volcanoes, one of them active. He was the discoverer of the Antarctic land mass.

This, then, was the information before us. The Antarctic continent was near the Antarctic circle, quite far north, on the Australian and African meridians, but far to the south on the American meridians. Our object was to establish a base in the heart of the Antarctic region, and there was the choice between the line of Weddell's furthest and Sir James Ross's route. The latter was selected because it offered the greatest certainty of valuable results. The base was, therefore, to be nearly in 78° S. on the 166th eastern meridian.

On March 21, 1901, Lady Markham launched at Dundee the good ship *Discovery*, admirably suited in every respect for the difficult and important service on which she was to be employed. The expedition was fortunate in its commander, in its officers and crew, and in its ship.

We now proceed to examine how far the programme laid down by Sir John Murray, and adopted by the Societies which dispatched the expedition, was carried out by Captain Scott and his companions.

1. The edge of Ross's ice-barrier was carefully examined from end to end, soundings were taken along its length, a landing was effected in order to try experiments with a balloon, the character of the surface-ice was ascertained, it was discovered that it extended for hundreds of miles to the south, that it had broken away 30 or 40 miles since the time of Ross, that there is a rise of temperature below the surface, and that in one part there is a movement of 608 yards in 13½ months.

2. Captain Scott's next discovery was the mass of land bounding the ice-barrier to the east, which was named "King Edward's Land." It is very high, with rock-patches showing out from the snow at an elevation of 2000 feet. Great interest attaches to the geology of this land because it may be a continuation of the Andean formations.

3. The next discovery was Ross island with its volcanoes and the long and

narrow basaltic promontory named Minna Bluff. A thorough study was made of the volcanic formations of this region.

4. Captain Scott's journeys and researches established the existence of a range of mountains at least 1000 miles in length, probably much more, extending from Cape Adare to the other side of the pole. Sir James Ross saw the mountains from a distance, it was reserved for Captain Scott to explore them and discover their character and formation. He found that they served as buttresses to an interior ice-cap, and that gneissic and granitic rocks form their base. Above this base the Beacon sandstone formation along the whole chain presents horizontal structure and an absence of any lateral pressure. The dolerites occur in extensive sheets capping the sandstone. This great chain of mountains with peaks attaining heights of 15,000 feet is broken at intervals of about 100 miles by ravines filled with glaciers. A journey to the south as far as 82° 17′ in the first season, and a journey up the Ferrier glacier to a height of 9000 feet in the second season, combined with the investigations of Mr. Ferrar and others, enabled geographers to acquire a detailed knowledge of the Victorian mountains. This was a very different result from the mere sighting of mountains from the deck of a ship at sea.

5. In rear of these Antarctic mountains is the great ice-cap, the most extensive mass of ice in the world. Its existence had been assumed, but it was discovered by Captain Scott when he reached it with two men after ascending the Ferrar glacier. He faced appalling hardships and difficulties with his two companions in advancing over the ice-cap for 160 miles to the west, at right angles with the line of the mountains. One of the results of this very remarkable journey was the series of magnetic observations which, combined with those at winter-quarters, fixed the position of the magnetic pole. The position itself was afterwards reached by Mr. Mawson. Scott's whole journey occupied eighty-one days, during which they marched over 1908 miles, climbing up 9000 feet, and averaging 15·4 miles a day.

6. Another most interesting discovery was that the Antarctic land-ice was receding, and not advancing.

There was evidence of recession in all the glaciers that were examined, while the coast bears evidence of the existence of the old ice-sheets in curious formations, which can be accounted for in no other way. The greater severity of the temperature is caused by the decrease in precipitation and the consequent shrinkage of glaciers and ice-fields.

Captain Scott was the founder and originator of Antarctic sledge travelling, which differs in several respects from Arctic travelling. The constant weights, sledge, tent, sleeping-bags, cooking apparatus, diet, clothing, and routine, were all thought out with the greatest care and to the minutest detail.

7. The expedition further made complete series of magnetic, meteorological, pendulum, and tidal observations, and large collections by trawl and dredge, also diligent observations respecting emperor penguins and the two other birds of the far south, mammals, and fish, all recorded in five volumes issued by the British Museum authorities. These were indeed magnificent results.

Yet the work could not be completed in that section of the Antarctic regions even in two seasons. There remained the discovery of fossils to fix the period of the Beacon sandstone, the extension of a line of magnetic observations to the South Pole, and the discovery of the problems connected with the great ice-barrier and the mountains on either side of it. As soon as the requirements of his profession would admit of his absence, Captain Scott, ably assisted by his second in command, Lieut. Evans, organized a final expedition—final as regards that section of the Antarctic continent. When the *Terra Nova* left England she was to convey to the Antarctic

regions the best equipped expedition for scientific research that ever entered the Polar regions.

We cannot yet really take stock of the results, for they are but half completed. But we know and are proud of our commander; we can feel certain that the work is sure to be done well under such a man, and we know that he works with a splendid and most able staff. We also know that he is supported by a head of the scientific staff in Dr. Wilson whose gifts as a polar explorer are of the very highest order.

In the depth of a polar winter Dr. Wilson and two companions went forth on a biological quest. They went forth to face the most extreme cold and the fiercest gales in darkness. This was something new. But that they should have persisted in their efforts in spite of every adversity for *four full weeks* is heroic. It is one of the most gallant stories in polar annals, and the names of Wilson, Cheny Garrard, and Bowers will be remembered so long as Britain cherishes the memory of the heroic deeds of her sons. Such are the men who will support Captain Scott in his second season. We have Scott's first report, and we can make a forecast, to some extent, of what his second will be.

In the first season there were geological expeditions, and the first great success was the discovery of fossils which will establish the geological position of the Beacon sandstone. The next was the journey to the South Pole. Captain Scott had already ascertained that the pole was on the ice-cap, from the trend of the land to the east of south. The great distance necessitated the use of ponies and dogs as far as where the glacier was to be ascended. Every detail had been thought out with that thoroughness which is characteristic of the great Antarctic leader, and the achievement of his object was, humanly speaking, certain. But he had to consider the exigencies of the second season. The teams of dogs must be reserved. Captain Scott therefore resolved that the journey from the foot of the glacier to the pole, a distance of 1200 miles there and back, should be done by himself and his men dragging their own provisions and constant weights. This is the true British way. Lieut. Mecham, in 1854, averaged 20 miles a day for seventy-seven days. No dogs have done that in the Polar regions. Captain Scott has discussed the question with his usual fairness and ability in his work on the 'Voyage of the *Discovery*.' "Dogs greatly increase the radius of action," he says, "but to pretend that they can be worked to this end without pain, suffering, and death is futile. Such sordid necessity robs sledge travelling by dogs of much of its glory. In my mind, no journey ever made with dogs can approach the height of the fine conception which is realized when a party of men go forth to face hardships, dangers, and difficulties with their own unaided efforts, and by days and weeks of hard physical labour succeed in solving some problem of the great unknown. Surely in this case the conquest is more nobly and splendidly won."

Captain Scott worked out all the details with precision and exactness. The journey was made by three sledges of four men each, forming depôts at regular distances, so that one could reach the pole. At 87° 30′ Scott proceeded to the pole with one sledge full up with provisions. The second sledge returned under the command of Lieut. Evans. Unfortunately, that gallant officer was attacked with a severe illness on the return march, and had to be invalided. He had done splendid service in raising funds for the expedition, in the fitting out, in the voyage, in the laying out of the depôts, and perhaps above all in his observations and surveying. His great services were appreciated. On July 1 Evans was promoted to the rank of commander for Antarctic service, and was received by the King.

Captain Scott will have reached the South Pole on about January 14. His return to safety has been amply provided for by the depôts, and at this time he and

his gallant companions are enduring the rigours of their second Antarctic winter, and preparing their next great service to geography. Scott will have taken magnetic observations from the winter quarters to the South Pole, the only practical reason for going there.

I have reason to believe that the intention of Captain Scott is to proceed along the coast as far as possible to the south in the next season, thus solving the problem of the great ice barrier, and ascertaining the direction of the Victorian and Edwardian mountains and whether they unite or not. The seiche detected in the tidal observations in McMurdo sound during Shackleton's expedition, would be accounted for if the opening on the Great Barrier extended through to the Weddell sea with a constriction where the supposed end of the bay is placed. The tide would then oscillate with such a period. But we must wait for these interesting discoveries until next spring. They involve a point of extraordinary interest. We know that on the Victorian side the mountains present horizontal structure, and the absence of any lateral pressure. But students of Andean geology find very different conditions in Patagonia, and these conditions of disturbance continue in the South Shetland islands and Graham land. Moreover, a volcanic rock, peculiar to the Andes, has been found in these far southern lands. The question whether the Edwardian mountains belong geologically to the disturbed Andean formations or to the horizontal Victorian parallel range is one of the greatest interest which we hope Captain Scott will solve. It is immaterial whether the two ranges are joined by land or separated by a strait as the tidal phenomena indicate, from the point of view of their geological structure.

Dim rays of light break in upon us as we learn more of the geology of Patagonia and the far south, and of their fossil fauna. Possibly they once formed part of a now submerged continental area, extending southward to Antarctic Edward land at a time when climatic conditions made it an abode for man. The great ice-cap holds the secret.

A very important result of Captain Scott's persistent determination to complete the work of exploration in the Victorian quadrant will be that there will be a complete series of meteorological, magnetic, and tidal observations for four years, including those made by the observers in Shackleton's expedition, for five years. In Greenland M. Porsild has established an observatory but not so near the Pole, and the observations in McMurdo sound are unique in this respect. There will be complete series of observations for pressure, temperature, wind velocity and direction, while the upper atmosphere is investigated by means of small balloons showing the directions of upper currents to a height of 6 miles.

Captain Scott and five of his companions will have passed through four Antarctic winters, and have devoted their energies to geographical discovery during four Antarctic travelling seasons. Scott's two expeditions form the most important and the most fruitful enterprise that has ever been undertaken either in the Arctic or the Antarctic regions.

Our Antarctic views have now been adopted by two other expeditions, the aim of their leaders being to explore the Antarctic continental land by wintering and by sledge travelling. Captain Filchner left Hamburg in May, 1911, with the intention of taking the route of Weddell's furthest and forcing his way through the pack to the land which must exist to the southward. My impression is that the land on that side is distant, but that a navigable sea will be found to the south, formed by the ice drifting north from an ice barrier or a coast-line, as on the other side of the Antarctic area.

Captain Scott's discoveries show that the glaciers are not the sources of iceberg supply. The ice terraces resting on land only send forth small bergs. But the

icebergs in the Weddell sea are as large as those in the Ross sea, and probably have a similar origin, from a great ice barrier.

If Captain Filchner reaches it and effects a landing, most interesting geographical results may be anticipated. At all events, Captain Filchner has adopted the right way and we may consequently expect important results.

Mr. Mawson has chosen the lands seen at a distance by Balleny, Dumont d'Urville and Wilkes, as the scene of his efforts, probably because it is the nearest Antarctic land to Australia. He too has adopted the right methods. He has wintered on the Adelie coast of Dumont d'Urville's land, and intended both to explore the coast-line and to penetrate far over the ice-cap in the direction of the magnetic pole. Much good work may also be expected from the Mawson expedition.

Assuming the complete success of all the three expeditions which have wintered in the Antarctic regions, there is still much remaining for future explorers to achieve. The discovery and examination of the Edwardian coast from Cape Colbeck to the meridian of Graham land, comprised in the Ross quadrant, is the next most important work to be undertaken. It will be a difficult and, I believe, even a more than ordinarily perilous enterprise, but with a well-thought-out plan, it is feasible.

Next, there are the operations for ascertaining the depth of the ice-cap at several distant points, which has not yet been attempted. The great ice mass conceals many deeply interesting secrets. Then there is the opening reported by the *Challenger* to the east of Kemp Land, and the Kemp and Enderby coast-line to be examined. There is plenty of Antarctic work remaining to be done for many years to come.

Meanwhile, we must look forward to next spring, when the whole country will welcome the return of Captain Scott, one of the greatest of polar explorers, and hear of the geographical achievements of himself and his gallant companions with the deepest interest, and with well-founded national pride.

THE ANTARCTIC CONTINENT.*

By WILLIAM S. BRUCE, LL.D., F.R.S.E.

From the earliest times in the history of geography there had always been the theory of Terra Australis Incognita. To Peru at the end of the sixteenth century belongs the credit of sending out the first expedition in search of that continental land mass supposed to lie round about the South Pole and to extend northward even into subtropical regions. Cook, 1771–75, however, was the first to determine that, if an Antarctic continent existed, it must lie almost wholly within the Antarctic Circle, and Ross and Wilkes were the first to map out extensive parts of the coast-line of Antarctica from Edward Land in about 150° E. to Termination Land in 95° W., *i.e.* over one-third of the circumference of the globe in the latitude of the Antarctic Circle and to the south of it—a coast-line of fully 3000 miles in extent. Palmer, Johnson and Morrell, Biscoe, Ross, d'Urville, and others also discovered parts of the continent to the south of South America, while the discoveries of Biscoe and of the *Scotia* helped to link up these lands with those of Wilkes and Ross, and to verify Wilkes' nomenclature "The Antarctic Continent" and Murray's name "Antarctica."

While Ross was the discoverer of the extensive mountain range of Victoria Land,

* Abstract of a paper given to British Association, Dundee, September 9, 1912.

Armitage, by his pioneer journey, was the first to discover and travel on the high plateau of Antarctica, which Scott the following year proved extended far to the west of the Costal range. Scott and Royds showed that the Ross barrier extended at least 300 miles to the south and south-east, and Shackleton that it abruptly ended in about 84° S., and that the Victoria Land range trended across his path to the south-east. Shackleton ascended this range by the Beardmore glacier and discovered the South Polar plateau at an elevation of about 10,000 feet, and travelled over it to within 100 miles of the Pole, proving that the South Pole was situated on this plateau. Amundsen has confirmed this by his extended journey to the Pole itself. Amundsen has further traced the Victoria Land range to the south-east as far as 80° W. and 88° S. In 86° S. 160° W. he discovered a branch of this range running north-east, and in 81° S. and about 165° W., he saw "an appearance of land," which with the north-easterly range, and the extension of the Victoria Land range, definitely determines that the Ross barrier does not extend further south than 85° S. or further east than 165°, and throws doubt on the suggestion of Markham and others that this barrier runs across Antarctica, dividing it into two land masses—a theory that was condemned by the discoveries of the *Scotia*, and which I showed was impossible, at least, as far as the Weddell sea, in a paper published in the *Scottish Geographical Magazine* for August, 1905, entitled "Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea," and subsequently in a paper entitled "Ueber die Fortzetzung des Antarktischen Festlandes zwischen Enderbyland, Coatsland and Grahamland sowie das Vorhandensein von New Südgrönland." *

The *Scotia* made extensive bathymetrical researches, discovering and mapping the coast-line of Antarctica, where 2000 fathoms of water was supposed to exist, and thus adding to the area of Antarctica about 500,000 square miles.

The *Scotia* proved that where Ross thought he had 4000 fathoms—no bottom—only 2660 fathoms existed. It demonstrated, especially meteorologically, the probability of the existence of New South Greenland, and showed the existence of a "rise" stretching 1000 miles south of and an extension of the mid-Atlantic rise, which I named "The Scotia rise." This "rise" appeared to connect up with a "rise" between Bouvet island and the Sandwich group. The Sandwich group also appear to be connected by "rises" joining them up through South Georgia with South America and through South Orkneys with Graham Land. I believe this series of "rises" indicates former continental connections between South America and Antarctica and South Africa with Antarctica.

That Antarctica consists of one and not two main land masses is supported by the modern researches of the *Scotia*, as well as by the far south and east explorations of Shackleton and Amundsen.

The Antarctic continent in part lies almost wholly within the Antarctic Circle, and has an area equal to that of about Australia and Europe combined. Bathymetrically the *Scotia* demonstrated former land connections between South Africa, mid-Atlantic rise, and Africa, and the researches of Mawson are likely at the present time to prove former Australian and New Zealand land connections from the bathymetrical point of view.

These connections have long been upheld by naturalists, notably Hooker (1845), Rutimeyer (1867), Huxley (1868), Forbes (1893), whose striking map is well worthy of attention. Benham, Chilton, Hedley, Scharff, Osborn, and many others † also give a flood of biological evidence in support of land connections of Antarctica

* Scottish Oceanographical Laboratory Publications, 1910.

† 'Polar Exploration,' by William S. Bruce, chapter ii. Home University Library, 1911.

with New Zealand and Australia with South America, of Australia with South Africa, and South Africa with South America and the Aucklands. The researches of Pirie, and especially his discovery of graptolites in the South Orkneys, prove the existence of greater land extensions in former times.

To my mind all the evidence points to the existence of an Antarctic continent approximately equal to the area of Australia and Europe combined, viz. five and a half million square miles; that this continent consists of one land mass, not divided by any channels or ice-barrier, and was connected in former times with South America, the mid-Atlantic rise, South Africa, Australia, and New Zealand; that the backbone of Antarctica is carried across the continent on its Pacific side from Graham Land to Victoria Land, although a fault probably exists between the South American mountain system and the Australian New Zealand mountain system somewhere to the east of the Ross barrier. Generally speaking, Antarctica slopes more gently to the Atlantic and Indian ocean sides than to the Pacific, and the South Pole is situated on the Atlantic slope of the inland ice-cap.

Dr. R. N. Rudmose Brown emphasized the importance of the work of Bruce, Shackleton, and Amundsen in Antarctic geographical discovery, and pointed out that the great value of Amundsen's work lay in his having penetrated to the interior of Antarctica by an entirely new route and practically disproved, if any doubt remained, the existence of a strait across the continent. He maintained that after the determination of the outline of Antarctica the great problem was the elucidation of its structure. Our knowledge of the structure is at present confined to Graham Land and Victoria Land, though Amundsen has made discoveries in Edward Land that are not yet published. The folded nature of Graham Land is opposed to the plateau structure of Victoria Land, and we can only speculate on the junction of the two. Very possibly the Andean folds are lost by faulting somewhere to the south-west of Charcot Land, where the Andean zone of disturbance meets the hard Archæan and Palæozoic shield of Antarctica. In any case the greater part of the continent is probably of a plateau structure, the broken edges of which meet the sea in Victoria, Wilkes, Enderby, Wilhelm, and Coats Lands, and probably also Edward Land.

With regard to the structure of Antarctic icebergs, Dr. Brown contended that those of the Weddell sea were true icebergs coming from land-ice, and in this respect were unlike the smaller snow-bergs of the Ross sea, which are derived from the Ross barrier.

Mr. Eric Marshall: The Antarctic discoveries and researches of two recent expeditions call for special attention in the history of Antarctic exploration. The work of Captain Scott in 1902–3 was only the beginning of much that was to follow. Captain Scott was the pioneer of Antarctic travel, but the pioneer journey on to the Victoria Land plateau was performed by Armitage in 1902, and on to the Southern Polar plateau by Shackleton and his companions in 1908. The large discoveries accruing from the expeditions of Shackleton and Amundsen cannot be overlooked. Shackleton's journey towards the South Pole verified the trend and threw light on much of the formation of the land that borders the Ross barrier, and with the subsequent discoveries of Amundsen solved, to a great extent, the mystery of the Ross barrier itself. It proved the existence of a great Polar plateau, and the situation of the Pole on that plateau at an altitude of not less than 10,000 feet, and the existence of coal at a high southern latitude—85° 5′ S. The journey, with magnetic and geographical observations, of another party to the South Magnetic Pole was also valuable in results, and the ascent of Mount Erebus revealed much of geological and

meteorological interest. Shackleton's discoveries were the incentive to other explorers—Mawson and Amundsen—just as Scott's were to Shackleton. Amundsen pioneered an entirely new route to the Pole, and in so doing solved the formation of the Ross barrier, which Shackleton had predicted, and geologists now anxiously await the report on the specimens brought from King Edward VII. Land.

The use and value of dogs in Antarctic travel has been vindicated by Amundsen, and they should prove of the utmost value in all future work in the interior of the continent. In the future of Antarctic exploration, journeys along the lines of meridian polewards will yield much in the way of geographical discoveries, both as regards the formation of this plateau and the land surrounding it, and a transcontinental journey—having this object in view—from a base at Graham Land, Enderby Land or Coats Land is, I think, quite possible.

Mr. T. V. Hodgson: Followed as Sir Clements Markham has been by Dr. Bruce, we have an account of Antarctica from two widely different aspects. One hears a great deal now of the recession of glaciation in the Antarctic regions, and, speaking geologically in terms of thousands of years, probably this is correct, but little or no attention has been paid to vulcanicity. South Victoria Land swarms with volcanoes, and though only one of them has been seen to emit smoke, our acquaintance with the rest is far too limited to justify them being regarded as extinct. The animal remains (marine animals) found in the vicinity of McMurdo sound clearly indicate that the land is rising, and all trace of a big volcanic disturbance would be lost under a snow covering in a few weeks unless the land was examined in far greater detail than has yet proved possible on the sledge journeys hitherto undertaken. Notwithstanding the diminution of the barrier since Ross's memorable voyage, I cannot regard this as anything more than a seasonal fluctuation, and the output of icebergs in the Ross sea is by no means derived from this source alone; there are numerous other glaciers on the shores of South Victoria Land from which small bergs, under 2 miles long, might readily be shed. The Drygalski glacier and the so-called glacier-snout in McMurdo sound require detailed examination.

Sir Clements Markham advocates human as against any other form of traction. This is a serious mistake, and though he may cheerfully undertake it, man is never at his best for scientific or indeed any other work when used as a draught animal. The experience of the *Discovery* proves that dogs are invaluable, but it is essential that they are purchased young, or better bred, by those who are about to use them.

One thing that impresses a visitor to these regions is the majestic beauty of the scenery, with its wealth of problems waiting for solution. As seen from the coast the icy covering is remarkably thin, and though at present we have had no means of measuring the thickness of the inland ice, it does not impress one as being of the enormous thickness it was once supposed to be.

Prof. Chilton (of Christchurch, New Zealand) said that New Zealand had been closely associated with the history of Antarctic discovery. It had been visited by Sir J. C. Ross's in 1839–40, and Christchurch was the base station for the recent expeditions under Captain Scott and Sir E. Shackleton. For the explanation of the Antarctic element in the New Zealand fauna and flora it was necessary to have a fuller knowledge of the sea-bottom between New Zealand and the Antarctic continent than it had been possible to obtain up to the present.

Other expeditions, especially the Scottish National Antarctic Expedition and the Swedish, had greatly extended our knowledge of other parts of the Antarctic continent, and the evidence gained by a study of the fauna and flora of the various sub-Antarctic islands pointed to former extensions of the continent northwards at a

time when the climate in Antarctic regions was much warmer than at present. The fossil plants discovered by the Swedish expedition at Seymour island gave proof of a former warmer climate, and showed considerable affinity to the existing flora of New Zealand, and the resemblances between the existing and the fossil faunas of New Zealand and South America seemed to point to former land connection, more or less continuous, by means of the Antarctic continent.

REVIEWS.

EUROPE.

The Dalmatian Coast.

'Dalmatien und das österreichische Küstenland.' Vorträge gehalten im März 1910 anlässlich der ersten Wiener Universitätsreise von Prof. Dr. M. Dvořák, Prof. Dr. M. Haberlandt, Sektionsrat Dr. F. Karminski, Prof. Dr. N. Krebs, Prof. Dr. H. Kretschmayr, Privatdozent Dr. A. Merz, Prof. Dr. E. Oberhummer, Prof. Dr. E. Reisch, Prof. Dr. M. R. v. Resetar, Sektionschef Dr. R. Riedl, Prof. Dr. J. Strzygowski, Prof. Dr. F. Werner, Prof. Dr. R. R. v. Wettstein. Herausgegeben im Auftrage des Rektorats der Universität Wien von Prof. Dr. Ed. Brückner. Vienna and Leipzig: F. Deuticke. 1911. v. + 250 pp. 64 *Illustrations*, 1 *Sketch-map*. 4 *marks*.

The many attractions of Dalmatia are drawing increasing numbers of visitors to the north-eastern coast of the Adriatic; most of them cruise along its shores, and comparatively few go inland among its still hotel-less valleys. This excellent summary of the geographical features of the country should therefore be very useful. The work was prepared in connection with the first geographical excursion from the University of Vienna. Three hundred members of the geographical school visited the coast on an Austrian Lloyd steamer, the excursion lasting ten days. The students had been prepared by a week's special course of lectures, which form the basis of the present work. It consists of fourteen essays (ten of which are by Professors or Privat-Docents who were connected with the excursion), and is edited by Prof. Brückner. In the two first chapters Prof. Krebs summarizes the physical geography of Dalmatia, and Dr. Merz that of the Adriatic sea. Prof. F. Werner describes the fauna; the most interesting quadruped is the jackal, whose howl can be heard on the island of Curzola, though it is difficult to see and still more difficult to shoot. The historical geography of Dalmatia and Hercegovina is contributed by Prof. Oberhummer, while the Venetian and oriental influences are discussed by Prof. Kretschmayr and Prof. Strzygowski.

The chapter by Prof. Reisch on the Roman antiquities is one of the longest, and will probably be one of the most generally useful. The account of Diocletian's palace at Spalato includes figures showing it as reconstructed according to recent information. Prof. Haberlandt deals with the folklore of Istria and Dalmatia, and Prof. Rešetar contributes a series of Slovenic and Serbo-Croatian folk songs.

The economic geography of the country is discussed in an especially interesting chapter by Dr. R. Riedl, head of a department in the Austrian Ministry of

Commerce, who considers the reasons for the commercial backwardness of Dalmatia, and appeals to Austria to push forward the development of the land. He is perhaps optimistic as to its intrinsic wealth, as shown by his remarks on its mineral resources and power; and he perhaps does not allow sufficiently for the high proportion of bare rock in the country. The essential poverty of the land offers an easy explanation of its present industrial condition.

The book is illustrated by numerous excellent photographs; photography is forbidden in some of the most interesting localities, but the members of the University party appear to have had no difficulties placed in their way by the officers of the Austrian-Lloyd steamers, some of whom extend the areas in which photography is banned to the whole Dalmatian coast.

The book may be confidently recommended to visitors to Dalmatia as an instructive introduction to its geography. The articles would have been of even more use to general students if they had included some lists of literature. Dr. Oberhummer gives numerous references in his chapter, but he is exceptional in this respect.

J. W. G.

ASIA.

The Tibetan Frontier.

Jacques Bacot, 'Le Tibet Revolté.' Vers Nepemako, la terre promise des Tibétains. Paris: Hachette. 1912. 15 *frs.*

From time to time reference has been made in our pages to the travels of M. Bacot in the difficult and still very imperfectly known region between Ta-tsien-lu on the Chinese side and Assam on the west. In a volume of 364 pages, illustrated with photographs and maps, M. Bacot describes his experiences in the course of his second journey in the latter part of the year 1909, his previous travels having been particularized in "Dans les marches Tibétaines."

On the later occasion his objective point was the mysterious Poyul country, of which many marvellous tales had been told to him, and which he had succeeded in approaching within twenty days' journey in 1907. Although M. Bacot succeeded in penetrating as far north as Changu, 31° 30′ N. lat., Poyul was not to be discovered, and the author was led to turn his route due south to Litang, Konkaling, and Sampilling, into the heart of the country which had been devastated by the war between China and Tibet. The hydrography of this region, watered as it is by the upper Irrawadi, Salwin, Mekong, and upper Yang-tse with their innumerable tributaries, is highly complicated. Various gruesome stories are told by M. Bacot of the hostilities that lasted so long: the siege of Sampilling endured for six months at the hands of the notorious Chinese general Chao-Erh-Fong, and was marked by several ferocious incidents. Thence M. Bacot proceeded eastward on a quest for another visionary country, which he was unfortunately unable to locate, namely Nepemako, the land of promise of the Tibetans. According to the description vouchsafed to him, this mysterious tract ought to have cropped up somewhere between the sources of the Irrawadi and the middle Salwin but it could not be identified. Instead thereof M. Bacot claims to have definitely lighted on the sources of the Irrawadi in a glacier south of the Lagenla pass, a point passed both by the Pundit Krishna and by Captain Bailey in his journey last year.

AFRICA.

Tripoli.

'La Tripolitaine d'hier et de Demain.' Par H. M. de Mathuisieulx. *Illustrations and Sketch-maps.* Paris: Hachette et Cie. 1912. 4 *frs.*

'Tripoli the Mysterious.' By Mabel Loomis Todd. *Illustrations.* London: Grant Richards. 1912. 7*s.* 6*d. net.*

'Italy's War for a Desert.' By Francis McCullagh. *Illustrations.* London: Herbert & Daniel. 1912. 12*s.* 6*d. net.*

Mons. de Mathuisieulx is already favourably known as a traveller in and a writer upon Tripoli. Six of the eight chapters in his latest volume are devoted to descriptions of journeys made by him in the interior of the vilayet and along the coast of Cyrenaica during 1903–07. They are of much interest, and demonstrate that the Roman settlements were more numerous and more prosperous than had hitherto been supposed. Ghirza, for instance, in the Wadi Zemzem, must for a long period have been a flourishing city, as is shown by the extent of its cemeteries. It had many magnificent buildings. Fascinating as are the travel chapters, especially to the archæologist, the first and the last, in which the author sums up the results of his explorations, are of particular interest in view of the Italian occupation of the Tripolitanate. Revising previous judgments in the light of fuller knowledge, Mons. de Mathuisieulx comes to the conclusion that the regions of possible profitable cultivation in Tripoli cover an area about half the size of France, that is about a fourth of the whole vilayet. The immense barley harvests of the Romans may once again be gathered if their successors take equal pains in irrigation works. The actual or potential cultivatable areas consist of (1) the oases in the coast region, which is otherwise hopeless; (2) the string of oases which line the foot of the mountains which mark the limit of the Jefara plateau; (3) the cañons, wadis, and hollows of the interior plateau of which the mountains of (2) form the northern wall; (4) the districts of Urfilla and Tarhuna in the east of Tripoli; (5) the Cyrenaican plateau. Besides cereals, the cultivation of the olive and the palm might be greatly increased. The author believes, also, that there is still a future for trans-Saharan trade; so much so that he recommends the construction of a harbour at Gabes in Tunisia as a rival to Tripoli city. But it is more probable that the trade of the central Sudan will be diverted southward and eastward. In appendices the geological and geographical results of the author's journey are considered in detail. The illustrations are specially attractive—many of them are of Roman antiquities. The book is without doubt the best which has appeared on Tripoli in recent years.

Mrs. Todd's volume is for light reading and serves its purpose well. She discourses charmingly of her experiences in Tripoli during visits paid in 1900 and 1905, when she accompanied her husband, Prof. Todd of Massachusetts, on his missions to observe eclipses of the sun. The book does not pretend to do more than preserve the record of a Tripoli which, so far as the capital is concerned, has now almost passed away. There are descriptions of the cosmopolitan peoples of the town, sketches of harem life, Arab weddings, and the like, all pleasantly told. At this juncture the book might be read with profit as an introduction to the study of things Tripolitan.

It is unnecessary here to enter into the charges Mr. McCullagh brings against the Italian troops in 'Italy's War for a Desert'—though that desert may yet in part, as Mons. de Mathuisieulx has shown, blossom like the rose. Mr. McCullagh is a war correspondent of wide experiences; his style is picturesque, and the tale

he has to tell is of painful interest. It would have gained in effect from a more restrained presentation. Some of the chapters in Part II.—written before the oasis massacres—show Mr. McCullagh at his best.

F. R. C.

'Tripolis.' By Ewald Banse. Weimar: Alexander Duncker Verlag. 1912. Pp. 158. *Maps and Illustrations.* 3 *marks.*

We have had but few modern books on Tripoli. The best are still those of the great travellers who started from Tripoli on their way south across the Sahara to the Western Sudan. On Tripoli town no serious recent work exists. Writers have called it a mysterious town, but of what the mystery consists we learn but little. We welcome the present volume by Mr. Ewald Banse, as it is the result of careful investigations into the life, habits, and social customs of the different races which form the population of the city of Tripoli—Arabs, Berbers, Negroes, Jews, and Levantines. Mr. Banse gained all his information during a stay of many months in Tripoli only a few years ago. The present volume is of value both to the ethnologist and the geographer, because the old oriental Tripoli will soon become modernized under the Italian administration. It presents a true picture of life in Tripoli under Turkish rule. The volume is profusely illustrated with well-chosen photographs and excellent drawings which remind us of the illustrations in Lane's classical book, the 'Modern Egyptians.'

A. V.

French Africa.

'L'Afrique occidentale Française.' Par Louis Sonolet.
'Le Congo Méconnu.' Par Jean Dybowski.
'A Travers la Chaouïa.' Par Captain Grasset.
Paris: Hachette et Cie. 1912. 4 *frs. each vol.*

These are new volumes in Messrs. Hachette's 'Collection de Voyages Illustrée.' M. Sonolet has produced a very workmanlike treatise on French West Africa. He is not concerned with the story of its exploration, or of its acquisition by France, but gives us an exposition of the state of the country as it is to-day. The organization, civil and military, commerce, agriculture, and such-like subjects are treated systematically, and there is a thoughtful chapter on the future development of the native races. Its geographical interest lies in helping us to some extent to form a mental picture of a vast and important region.

M. Jean Dybowski's book as to about a half is occupied with an account of how the French Congo was acquired, and with laments that its progress has been hindered through lack of interest in the country in France—this notwithstanding the pride felt in de Brazza's achievements. Chapters iv. and v. are in a different category. M. Dybowski in them tells us what the country looks like—a description which we can realize all the better with the help of the really good illustrations—and supplies valuable information on colonization and on the inhabitants. He lays stress on the African's aptitude for agriculture, and gives instances of the penchant of certain tribes for cannibalism (pp. 170–173). The conclusion to which M. Dybowski comes—his remarks chiefly apply to the tribes living in the Ubanghi region—is that cannibalism with them is due to economic causes, and "may perhaps be excused in certain measure." They lack cattle; supply them with beef and anthropophagism will cease. Another noteworthy point in this volume is the author's attitude towards Islam. He regards its spread among the fetish worshippers of the Congo with strong disapproval. Only

evil, he holds, can be the result; and of the central Sudanese Mussulman he writes with intimate knowledge.

Captain Grasset, writing as a soldier, gives an account of the operations of the corps which landed at Casablanca in 1907, and subsequently occupied the Shawia country. The interest of his book for geographers and travellers lies in its appendices, in which the history, orography, hydrography, geology, flora and fauna, and climate of the region are succinctly described. Two useful sketch-maps are given, and the illustrations are many and pleasing.

F. R. C.

AMERICA.

GUIANA.

'Guiana: British, French, and Dutch.' By James Rodway. London: Fisher Unwin. 1912. Pp. 318. *Illustrations and Map.* 10s. 6*d. net.*

This is the inevitable volume on 'Guiana' in Mr. Fisher Unwin's "South American Series," and it is written by Mr. James Rodway, who, of recent years, has written more than any one else on the subject of British Guiana. It was a fine opportunity, for it seems that there exists in the English language no full and recent account of the area now known as Guiana, and distinguishable into three parts according as it is held by British, Dutch, and French. It is unfortunate that the opportunity has been to some extent missed. The author, who knows a great deal about the British part of the area, is evidently less familiar with the circumstances of the Dutch, and especially the French, areas; and he does not seem to have made sufficient use of such books, certainly not very many, as have been written, in languages other than English, on the two sections less familiar to him.

Still, Mr. Rodway has given in this book a great deal of interesting, if somewhat ill-arranged, information on British Guiana. Perhaps the most useful thing he has here given us is the summary of the remarkable and romantic work done in the eighteenth century in laying the foundations of the three colonies of Essequibo, Berbice, and Demerara, which now, as three counties, constitute British Guiana.

The book is amply provided with illustrations, some of which are both artistic and interesting, the best of all being the frontispiece, from a photograph by Mr. F. V. McConnell, of the wonderful rock-formation and plant-growth on the summit of Mount Roraima.

A bibliography is provided, and was much needed. It seems ungracious to find so many faults with a book which is really worth reading, but truth compels the statement that the bibliography would have been much more useful if it had been fuller.

E. im T.

POLAR REGIONS.

THE GLACIAL PHENOMENA OF NORTH-EASTERN GREENLAND.

'Die Glaciologischen Beobachtungen der Danmark-Expedition.' I. P. Koch and A. Wegner. Danmark-Ekspeditionen til Grönlands Nordöstkyst 1906–1908. Vol. 6, No. 1. Meddelelser om Grönland, XLVI. Copenhagen: 1911. 77 pp., 5 pls., 9 figs.

The attempt to explain some British glacial phenomena by the assumption of a continuous sheet of ice which had floated across the Norwegian channel from Scandinavia was held to be contradicted by all Arctic evidence, for it was maintained that land-ice dissolves too quickly in sea-water for a glacier to flow out over an open sea without being broken into icebergs. This conclusion from Arctic

observations was the main cause of the former doubt whether Ross's Great Ice Barrier could be afloat. The power of land-ice to pass unbroken out to sea has now been proved for the Arctic Regions by the Danish Expedition to north-eastern Greenland in 1906–1908, for it discovered that the coast of Greenland from 78° to 79½° N. lat. is fringed by a continuous sheet of land-ice. This floating glacier is described and illustrated by many excellent and instructive photographs. This ice-sheet differs from that of the great Antarctic Ice Barrier, as it is composed of normal glacier ice, and not of snow consolidated *in situ*. The headquarters of the expedition were in lat. 75° 45′ N. near Dove bay, at the northern end of a long stretch of high but ice-free coastal mountains. The expedition explored the coast of north-eastern Greenland from 75° N. to 83½° N., and thus made a most important and difficult contribution to Greenland geography.

The second most interesting section of this monograph is on the inland ice, the structure of which is illustrated by a series of most valuable photographs. They show that the East Greenland ice has similar dirt bands, pressure banding, brecciated layers, and overthrust faulting to those which have been previously described from the glaciers of Greenland and Spitsbergen. The photographs include an especially clear example of a glacial thrustplane. The polygonal "Felderung," which Drygalski described from western Greenland, is well developed, and associated with it is a remarkable vertical grooving, which gives the glacier-front a fluted aspect. This structure is well shown in a series of photographs. The vertical ridges and furrows on the glacial face are due to a vertical banding caused by pressure.

The ordinary valley glaciers are of secondary interest; some of them lie in the flat-floored, flat-sided valleys which are often described as over-deepened, though they may be called betroughed, as they may be derived from ordinary sinuous river-valleys by the removal of spurs. The authors of the memoir made a detailed survey of a glacial cave; it offers no evidence of the deposit of sediment along the stream channel, and as in western Greenland, there are no esker-like fluvio-glacial formations in this district.

The text contains but few references to literature, but their absence increases the value of the work, as a careful, independent description and album of photographs of the glacial phenomena of the most inaccessible and least-known part of the Greenland coast. J. W. G.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Lossiemouth Geodetic Base.

An Account of the Measurement of a Geodetic Base Line at Lossiemouth, in 1909, together with a Discussion on the Theory of Measurement by Metal Tapes and Wires in Catenary.' Ordnance Survey. Professional Papers. New Series No. 1. Published by order of the Board of Agriculture and Fisheries. London: H.M. Stationery Office. To be purchased from Wyman & Sons, Ltd., Fetter Lane. *Price* 2*s*.

In his presidential address to the Geographical Section of the British Association at Dublin in 1908 it will be remembered that Major E. H. Hills, C.M.G., R.E., called attention to the desirability of remeasuring a certain portion of the principal triangulation of the United Kingdom to ascertain its reliability as compared with more recent geodetic work of other countries carried out with modern instruments. Later on in the same year the Council of the British Association brought the matter to the notice of the Board of Agriculture and

Fisheries, and on the recommendation of Colonel S. C. N. Grant, C.B., C.M.G., R.E., the then Director of the Ordnance Survey, it was decided that a portion of the old triangulation, executed something like eighty years ago, should be tested, by measuring a base with all possible accuracy in a suitable district remote from the principal bases of Salisbury plain and Loch Foyle, and from this extending a rigorous triangulation over a small area, as a check upon the earlier work.

The account of the measurement of this important base, with the results and computations in connection with it, are given in the first of a new series of Ordnance Survey Professional Papers, and will be interesting to all geodesists and surveyors. A suitable site for the base was found on the southern shore of the Moray Firth to the east of the town of Lossiemouth and situated between it and the river Spey, and the actual measurement was made in September and October, 1909, by Captain (now Major) Johnston, R.E., Captain Galbraith, R.E., and Mr. Gibson.

The base was measured with 100 feet invar tapes, of which five were used in connection with the operation. Two of these were standards which had previously been carefully studied at the Ordnance Survey Office, Southampton, while the remaining three actually used in the measurement were compared with the standards in the field. The tapes were suspended upon specially constructed tripods, and aligned by means of 5-inch transit theodolites, while a Cooke level of the ordinary reversible type was employed in the levelling.

The base was divided into sections, varying in length with each day's work. To commence with it was found that 1200 feet was as much as could be measured in a day, but this was increased to 2400 feet after experience had been gained. The final value of the base as measured is 23,525·97944 feet, with a probable error of 0·025 foot, or 1 : 900,000.

The report is systematically arranged, and the whole subject is fully discussed in the six chapters it contains. While all of these are interesting to the geodesist, some will be of special value for future reference, among which may be mentioned chapter iii., which deals with the 100-feet base at Southampton, made for the purpose of standardizing wires and tapes; chapter iv., treating of the fundamental standard of length, and chapter vii., which contains an elaborate mathematical discussion on the theory of tapes and wires in the catenary, due to Prof. O. Henrici, LL.D., F.R.S., and his son Captain E. O. Henrici, R.E., of the Ordnance Survey.

The first four chapters of this report were written by Major W. J. Johnston, R.E., and the remainder by Captain E. O. Henrici, R.E. There is a photographic view of the base in actual measurement, but it would have been an advantage if a sketch map had been added showing the situation of the base and its relation to the triangles to be measured from it. E. A. R.

GENERAL.

Ancient Geography.

'Quellen und Forschungen zur Erd- und Kulturkunde.' Von Dr. R. Stübe. Bd. 5. Byzantinische Quellen zur Länder- und Völkerkunde. Von Karl Dieterich. 2 parts. Leipzig: Otto Wigand. 1912.

With these two parts, separately issued, the one dealing with the elder settled peoples of the Byzantine world, and the other with the inflowing nomads, the fifth volume of Dr. Stübe's collection of annotated translations of the geographical notices in ancient authors is complete. The collection is a very acceptable one, if only for its excellent indices and succinct notes, the latter the work of various

scholars all known as specialists on various geographical regions, *e.g.* Prof. Weissbach, who takes Persia; Prof. Steindorff, who deals with Egypt, etc. It is true that one feels a doubt (as so often when looking through translations from the obscurer Greek and Latin authors) whether a translated delectus of this kind will really fill a much-felt want. The comparatively few who desire to use geographical passages in the Byzantine writers are seldom unable to read them in their original language, and very seldom likely to be content with translated excerpts. Nor does the present delectus contain by any means all that ancient geographers can use in the Byzantine authors, but only those passages in which these authors consciously set forth geographical information. Yet every one, who has had to work on ancient topography, knows that it is possible to derive information at least as valuable from other passages in which the author had no thought of conveying it, *e.g.* from all sorts of chance statements which fix distances, direction of roads, provincial boundaries, and so forth. The idea of Dr. Stübe's collection, however, is rather to illustrate ancient knowledge of geography than to increase modern knowledge of the ancient world; and Dr. Dieterich succeeds in showing in this latest volume that, though interest in geography was not a marked feature of the Byzantine literary class, it was by no means non-existent in that class. Short accounts and appreciations of the principal Byzantine authorities add to the value of a book which will commend itself to scholars as a labour-saving appliance in the early stages of their work, even if it will not prove sufficient in itself for their more advanced researches. D. G. H.

Educational Books.

'Man and his Conquest of Nature.' By M. I. Newbigin. (London: A. & C. Black. 1912. Pp. vi., 183. *Illustrations.* 2*s.*) Miss Newbigin has brought together, in a form suitable for children of school age, the subject-matter of those studies in human geography with which the names of Profs. Brunhes and Vidal de la Blache, among others, are associated. She successfully portrays the ways in which "man thrives more at certain parts of the globe than others." There can be little doubt that both teachers and scholars would gain greatly from the careful study of this little book, which opens up vistas of geographical development, and suggests trains of geographical reasoning which are lacking in the general run of English schoolbooks.

'The Teaching of Modern Subjects: Geography.' By James Welton and W. P. Welpton. (London: University Tutorial Press, Ltd. 1912. Pp. 80. 1*s.*) These eighty pages, which are reprinted from Prof. Welton's 'Principles and Methods of Teaching,' are noteworthy for the sound instruction in methods of geographical teaching which they contain. One point of great interest is the insistence upon models as a necessary class of apparatus for the study of small and possibly of large areas.

'Regional Geography: The World.' By J. B. Reynolds. (London: A. & C. Black. 1912. Pp. vii., 360. *Many Maps and Diagrams.* 3*s.* 6*d.*) This book is well up to the standard of Miss Reynolds' previous work on similar lines. The early chapters, which include the parts dealing with the British Isles and Europe, are rather more simple in treatment than the later chapters, which survey the other continents and conclude with a summary of the world as a whole. The regional aspect of each country is briefly described, and a general synthesis of these earlier descriptions is suggested in the final chapters upon the whole world. The maps, etc., are particularly clear.

'The Marlborough Country: Notes, geographical, historical, and descriptive.' By H. C. Brentnall and C. C. Carter. 1912. (London: Henry Frowde. Pp. 171.

50 *Illustrations.*) The authors have laid teachers under a great obligation by this study of the country shown on Sheet 266 of the 1-inch Ordnance Survey. Our pupils must learn the detailed geography of England by sample. They can only be expected to be familiar with the Ordnance Survey sheets of their own and perhaps three other districts. For this reason this study of the Marlborough Country is of a double value—first, as a sample to the teacher which will suggest to him the methods he may use in the study of the map of his own district; and secondly, as a sample district, which can be studied from this excellent little work, and from which can be inferred by analogy the geographical principles which may be expected to account for some of the characteristic features of the neighbouring areas in southern England.

'Geography Notes: British Empire.' By J. C. Chute. (London: J. M. Dent & Sons, Ltd. 1912. Pp. vi., 93. 2*s. net.*) Teachers who are pressed for time should welcome this brief summary of the points with which they might be expected to treat in their lessons upon the British Empire.

'A Geography of Europe.' By T. Alford Smith. (London: Macmillan & Co., Ltd. 1912. Pp. xii., 272. *Illustrations.* 2*s.* 6*d.*) This, the latest volume in the publishers' series of "Practical Modern Geographies," resembles its predecessors in the clearness of the maps and illustrations, and in the treatment of each lesson with preliminary exercises and additional revision exercises. The countries of Europe are grouped into five regional districts, and, with the exception of the British Isles, which are the subject of an earlier volume in the series, each country is then treated in detail so as to emphasize its essential geographical features. Stress is naturally laid upon the human aspect of geography, and although there are many tables of quantitative matter, these are used as the data for exercises, and hence are duly subordinated to the descriptive treatment, which is a feature of the work as a whole. Mr. Smith is to be congratulated upon a thoroughly sound study of the geography of Europe.

'Europe: a supplementary geography.' By J. F. Chamberlain and A. H. Chamberlain. (New York: The Macmillan Co. 1912. Pp. 258. *Illustrations.* 3*s.*) This is a descriptive geography of the countries and their peoples, with many illustrations based upon photographs, and several coloured political maps.

'High School Geography: physical, economic, and regional.' By C. R. Dryer. (New York: The American Book Co. 1912. Pp. 536. 368 *Illustrations.*) Half of this American schoolbook is devoted to physical geography, about fifty pages to economic geography, while the remainder deals with regional geography. Land forms, well illustrated by photographs and coloured contour maps, receive full treatment in Part I., which also contains a chapter on the economic relations of streams, dealing with questions of water-power and water-supply, and discussing the Mississippi and the Ohio. The work of ice, standing water, and winds are described to lead up to a chapter on soils. Other matters are the sea and its coasts, the atmosphere and climate, plant regions, and the geography of animals. In the economic section the chapters refer to food-supply, clothing materials, sources of power, manufactures, trade, and transportation. In the regional section half the pages deal in detail with the regions of North America; the rest of the world is treated more briefly, with less detail the further the region lies from the United States—thus, for example, the province of second importance is the "West European" province. This somewhat full description of the contents of the book is submitted as an index of what is meant by High School Geography in the United States. Great stress is laid upon the physiographic basis of geography, both in Part I. and Part III.

B. C. W.

'The Sea Road to the East.' (Six lectures prepared for the Visual Instruction Committee of the Colonial Office.) By A. J. Sargent, M.A. (London: Philip. 1912. Pp. viii., 124. *Maps and Illustrations.* 1*s.*) The Visual Instruction Committee of the Colonial Office, continuing its series of educational publications, issues in this volume lectures on Gibraltar, Malta, on the route from Malta to Aden, Ceylon, the Malay peninsula, and the Chinese stations. In textual form, they are illustrated with a few rather rough but adequate sketch-maps, and a number of appropriate photographs. The lectures themselves are admirably descriptive, and, when illustrated by the series of lantern slides designed to accompany them when spoken, could hardly fail to interest the audiences for which they are intended.

PROPOSED SCIENTIFIC EXPEDITION TO THE KARAKORAM.

Dr. Filippo de Filippi has submitted to the Council of the Society the plan for a scientific expedition which he has projected to the western Himalaya and Karakoram, and which he proposes to execute if the necessary funds should be collected. It is greatly to be hoped that Dr. de Filippi should have the means at his disposal of carrying through this enterprise. His experience of the district, gained during the expedition of the Duke of the Abruzzi on the Baltoro glacier, embodied in the book which has recently come before the public, and his familiarity with the problems of scientific geography are a guarantee for the success of the undertaking. Dr. de Filippi's plan deals mainly with work in the various branches of physical geography. The work will be carried out by a select number of specialists with the best of modern instruments, and every condition of accurate scientific investigation will be severely carried out.

The problems under investigation concern topography, geology, gravity, magnetism, the various forms of radiation (thermical, photochemical, photoelectrical, light-polarization, etc.), atmospheric electricity (potential gradient, electric conductivity, induced radio-activity, penetrating radiation and ionization of the air). To these subjects would be added studies in meteorology, with the special view of investigating the higher atmosphere with kites carrying self-registering instruments sent up from stations of high altitude. The special physical characteristics of the Himalaya-Karakoram region, added to the comparative facility with which high altitudes can be reached in it, to the dryness of the atmosphere, etc., afford unique opportunities for these researches. It is proposed to carry on the investigations from Kashmir, over the Himalaya range and through Baltistan and Ladakh into Chinese Turkestan. Dr. de Filippi proposes to take advantage of the occasion afforded by the expedition to explore and map the still unknown portion of the Karakoram between the Siachen glacier and the Karakoram pass. It would be a matter of the greatest interest in this district to look for a continuation of the great sedimentary (limestone) formation discovered by the expedition of the Duke of the Abruzzi in the Baltoro basin, and by Dr. Longstaff at the head of the Siachen glacier.

Finally, if sufficient funds be forthcoming, the value of the expedition would be enhanced by the addition of a naturalist and of an ethnologist and archæologist.

The plan entails wintering in Baltistan or in Ladakh, and the expedition would extend over a period of something more than a year.

The amount necessary to cover the expenses of such an enterprise is about £10,000. Half of this sum has already been contributed abroad (£4800 in Italy). In the interests of science we trust that the amount necessary to complete the sum may be subscribed.

THE MONTHLY RECORD.

EUROPE.

Physical History of the Upper Liffey.—Prof. Grenville Cole has an interesting paper on "The Problem of the Liffey Valley" in the *Proceedings of the Royal Irish Academy*, vol. 30, Sec. B, No. 2 (August, 1912). Although concerned primarily with a special question, viz. the origin of the sharp bends by which the upper courses of the Liffey and its tributary, the King's river, suddenly abandon their northern for a south-westerly course, the paper contains much that is suggestive in connection with the past surface history of South-Eastern Ireland. The natural explanation for the sudden change of course is that the rivers, which may be supposed to have once maintained their northerly course, were intercepted by a stream working back from the south-west. The supposed former continuation of the Liffey to the north would have led through valleys in the neighbourhood of Brittas, which, being broad and mature, well fulfil the conditions necessary to the assumption. But their northward continuation is by the Slade of Slaggart, a strikingly immature valley dropping steeply northward, and at present occupied only by an insignificant stream. This feature requires a special explanation, help towards which is given by a study of other immature features of the lower portion of the Leinster chain. The preservation of the lower slopes from stream action until almost recent times may be accounted for either by a possible invasion of the Pliocene sea, or by their protection by a now lost covering of Cretaceous strata. The southward diversion of the upper Liffey across a well-marked barrier at Pollaphuca must be explained in reference to the glacial history of the district. The wide basin of Blessington, through which the Liffey and King's rivers pass to reach the Pollaphuca barrier, is held to have been excavated by the ice which once passed over from the north, the schists and shales of this area being specially liable to go to pieces under glacial conditions. Towards the close of the Ice Age the hollow became filled with drift, which held up the resulting southward drainage, and enabled it to pass over the Pollaphuca barrier —essentially a young feature, best explained by the supposition that the river has only recently begun to flow in this direction. Some may be disposed to question the power of the ice to excavate a basin 250 feet in depth, even in easily eroded strata, but it is certainly difficult to account for it in any other way. Prof. Cole allows that his suggestions are not always capable of proof, but their interest is undoubted, and should yield fruit in promoting a fuller study of the physical history of this part of Ireland.

The Eruption of Etna, September, 1911.—Detailed accounts of the great eruption of Mount Etna in 1911, and its effects, are now available. In the July number of the *Revista Geografica Italiana* Dr. G. Platania, who made an ascent of the mountain soon after the eruption began, describes the successive phases of the phenomenon from the first appearance, on September 10, of a dense column of vapour mixed with ashes discharged on the north flank of the mountain, to the early days of October, when a slight recrudescence

of activity, which set in on September 29, again gave place to quieter conditions. Particularly vivid is his description of the great lava-flow as seen on September 13, the direction of the wind permitting a near approach to its western flank. The lava was exceptionally fluid, and at one point reached the enormous velocity of 5 to 6 metres (16 to 20 feet) per second. The spectacle is likened to that of a lake of molten gold agitated by a violent tempest. Dr. Platania gives photographic illustrations and descriptions of the series of vents, cones, and craters, arranged along the great fissures which, side by side with the increased activity of the main crater, formed a characteristic feature of the eruption. In the absence of a map it is not always easy to grasp their distribution and arrangement from Dr. Platania's narrative. They are divided by him into four groups, occupying different parts of the fissured area, though no very decided distinction is drawn between the groups as regards their essential characters. In this respect, as also in the provision of a map, a second paper printed in the *Beiträge zur Geophysik* (vol. 11, 2–4 Heft, 1912) forms a valuable supplement to Dr. Platania's. Its author, Dr. A. Sieberg, visited the scene of the eruption immediately after the most active phases had closed, and he concerns himself chiefly with the causes and results of the catastrophe. In describing the phenomena observed in the fissured area on the north-east slope of the mountain, he distinguishes (*a*) a series of "explosion-funnels" occupying the upper portion of the new fissure, stretching north and afterwards north-east from the foot of Monte Nero delle Concazze, on the eastern edge of the Pizzillo terrace. The size varies greatly, but all the craters are alligned regularly along the course of the fissure. Near the eastern foot of the Monte Nero di Linguaglossa the system splits into two branches, of which the more southern forms (*b*) a series of cones built up of fragments of lava which have retained their plastic condition on falling, and have therefore become welded together into a continuous mass ("Schweissenschlackenkegel"). The fragments are of the most varied shape, and show no definite arrangement, while the cones often rise at a very steep angle. They are placed so close together as to form in places a continuous wall or embankment. (*c*) The cones of the more northern branch, on the other hand, are formed of loose fragments of lava, the original magma having been here richer in gas. The ejected matter has therefore been burst into small particles, which have cooled before reaching the ground. Dr. Sieberg discusses the reason for the great difference between the forms of the craters at different portions of the fissure, attributing it in the main to the vertical gradation of the material within the shafts and passages, which brings it about that the coarser materials are ejected at the lower, the finer at the higher vents, while at the lowest of all the molten lava itself finds issue. The differences between the two lower (parallel) branches are, however, less easy to account for. As regards the origin of the fissures, Dr. Sieberg does not accept the explanation of previous observers that a sudden rupture occurs at the surface. He shows reason for believing that the outpourings of lava take place along a previously existing subterranean fissure, and supports this conclusion by showing that the series of fissures on both the north and south sides of the mountain belong to one system, the line of which, when prolonged, passes through Volcano and Stromboli, thus indicating the presence of a great line of weakness in the Earth's crust.

ASIA.

The Irrigation Works in Mesopotamia.—The first instalment of the vast works planned by Sir W. Willcocks for the irrigation of Mesopotamia by the storage of the Euphrates water is now nearing completion. Details as to the

present position of the work, which is being carried out for the Turkish Government by the engineering firm of Sir John Jackson, Limited, have lately been received by Reuter's agency. The part of the scheme first taken in hand has been the building of the great barrage at Hindieh, with associated works by which the water is to be distributed down the old branch of the river, past the site of Babylon, to Hilla. The barrage is being built to the east of the present bed of the Euphrates, and will be 250 metres long, with thirty-five arches fitted with sluice-gates. The piers of these arches are now completed up to the springing of the latter. This barrage will raise the level of the water by 7 metres, while a subsidiary barrage immediately below will provide for a further difference of 2½ metres. Adjoining the upper barrage there will be a lock for the use of the river traffic, while the lower barrage consists of a lock and a huge shelf of masonry. Work has also been begun on the Hilla regulator, a little above the barrage, which will consist of five arches. The excavation for this has been done, and the masonry begun. These works finished, an earthen dam will be thrown across the stream, which will thus be turned into its new bed between the barrage and the regulator. The old branch has been cleared out, and will be properly canalized, while at Habbania an escape is being constructed by which the flood-water will be carried off into the old Babylonian reservoir. It is estimated that 600,000 acres of land will be plentifully irrigated as a result of these works. The operations have involved a vast amount of excavation, concrete work, masonry, pitching, etc., but there has of late been a plentiful supply of local labour. Plans of the Hindieh barrage are given in Sir W. Willcocks's work on 'The Irrigation of Mesopotamia,' reviewed in the *Journal* early this year (vol. 39, p. 61).

The Flora of Kamchatka.—In a report on two years' work of the botanical section of Mr. Riabushinski's expedition (*Zemlevedeniye*, Nos. 1–2, 1911) Mr. V. Komarof states that volcanic outbursts and glaciation have thrust out and annihilated the old vegetation which formerly clothed Kamchatka in common with the nearest parts of North America and Japan. Only the coniferous forests of the central part, similar to those of Okhotsk, Sakhalin, and northern Japan, are left of the ancient flora. Subsequently there has been a new importation of Arctic forms from the Anadyr district, and whole trees are carried by currents from the rivers of Sakhalin and the Okhotsk province to the shores of Kamchatka, so that the south-western coast, notwithstanding its cold and gloomy summer, harbours many forms of the Okhotsko-Manchurian flora. On the north-western coast, from Penzhina to Tigil, on the other hand, there is a gradual advance southwards of continental plants. Lastly, in the south, as far up as the latitude of Petropavlovsk, are found forms not met with farther north, which have been introduced by birds or winds from Japan by way of the Kurile islands. On the whole, the vegetation of Kamchatka, though certain representatives are extensively developed, does not seem to thrive. Hard frosts, large accumulations of snow, and the extensive outflows of volcanic rubbish combine to check its growth. Like the flora, the fauna, including even the insects, is poor in the number of species, owing no doubt to the fact that Kamchatka is practically an island, the wide tundras in the north being a great hindrance to the migration of plants and animals.

Coal Resources of the Hokkaido.—An official paper lately issued in the series of Diplomatic and Consular Reports (Miscellaneous, No. 682) gives a useful account of the present position and prospects of the coal-mining industry in the northern Japanese island, formerly known as Yezo. The writer, Mr. H. Wrenacre, refers briefly to the discovery of coal in the island, first made in

1854 by the Japanese explorer Matsura, but not followed up until twenty years later, when the American geologist, Mr. B. S. Lyman, examined both the first-discovered field at Sorachi (Ishikari province) and the adjacent one of Poronai, besides discovering further deposits in the Yubari district. Later investigations have proved that coal also exists along the western slope of the central range, as well as on the south-east coast, though denudation has removed the coal-bearing strata from the central axis. An estimate in 1891 of the total amount of coal available as 600,000,000 tons has proved to be much below the reality, and as the estimated resources of the rest of Japan reach only 800,000,000, the possibilities of the industry in the future are evident. At present the development of the coal resources is almost confined to the Ishikari prefecture, and the total output hardly exceeds 1,500,000 tons. The Ishikari coal-measures, like the strata of the whole district, are of Tertiary age, and the average number of workable seams is four or five, usually about 5 to 6 feet thick, though one reaches 60 feet. The quality is generally excellent. A bituminous caking coal, found chiefly in Sorachi, Yubari, and Shinubari, shows excellent combustion, though dirty for steam purposes; while of the second principal kind—a bituminous non-caking coal, very hard, and with a brilliant lustre—the best is found at Poronai. This has a high reputation as a steam coal. The output has gradually increased of late years, but reduced prices have kept down the total value. Practically all the coal produced is used in Japan, the amount exported not yet exceeding 75,000 tons annually.

Further Surveys in the Abor Country.—It is announced from Simla that a renewed attempt will be made this winter to penetrate into the Upper Dihong valley and finally elucidate the connection of that river with the Sanpo of Tibet. The party will be in charge of Major Gunter, R.E., and will have an escort of military police.

AFRICA.

First Ascent of Mount Mawenzi, Kilimanjaro.—It is sometimes forgotten that the second highest peak of Kilimanjaro, the rocky mass of Mawenzi, was not ascended to its summit by Dr. Hans Meyer at the time of his conquest of the ice-crowned dome of Kibo. Nor until the present year had the feat been performed by any subsequent traveller. It has now been achieved by two Germans, Herr Eduard Oehler and Dr. F. Klute, communications from both of whom appear in the September number of *Petermanns Mitteilungen*. The former had had previous experience of Kilimanjaro as companion to Dr. Fritz Jaeger in 1906–7. The expedition, which took place during the summer of 1912, was not undertaken merely with a view to a mountaineering record, but a thorough examination of the physical characters of this part of Kilimanjaro was made, and a photogrammetric survey carried out. From headquarters in Moshi the travellers organized a small caravan and made a succession of trips, occupying a couple of months in all. They had with them three small mountain tents. A first attempted ascent from the south proved unsuccessful, and a wound in the foot obliged Dr. Klute to return to Moshi. On his recovery the survey was taken in hand in earnest, and eventually a successful attempt on the summit was made from the west, by a couloir reached from the direction of the north-west arrête. It led, partly over snow, partly over rock, to the topmost peak, which is the most northerly of all. The snow was in good hard condition, and young saw-toothed *névé* obviated the need of step-cutting. Evidences of former glaciation were found quite round the mountain, in the form of polished rock surfaces (reaching an extent of over 100 yards), moraine deposits, and erratics, but particularly in the nature of the relief, the trough-shaped valleys,

steep side walls and numerous *Kare*. So far as the ice extended the stream beds are little incised, but they are markedly so below the ice-limit. This may be placed at about 3600 metres (11,800 feet) above sea-level. During the whole tour of the mountain camps were pitched at altitudes between 3500 and 4600 metres. The travellers are reported to be continuing their investigations in the direction of Kibo.

Survey of Pemba Island.—The first survey of the East African Clove island was carried out in 1911, in accordance with recommendations of Major Gordon, R.E., by a party consisting of Captain Craster, R.E., Lieut. Kyngdon, R.G.A., and two non-commissioned officers, who arrived in the island at the end of May. Captain Craster describes the operations, which were rendered somewhat difficult by the climatic and other conditions of the island, in the *Royal Engineers' Journal* for September, 1912. A base of nearly 14,000 feet was measured on the largest of the chain of small islands which fringe the western shore of Pemba, but as nearly its whole length lay below high-water mark, the measurements could only be made at low water. Even so, the party were often working in a foot or more of water; but this had the advantage of keeping the steel tape at a uniform temperature. The probable error worked out at 0·4 inch or $\frac{1}{373000}$ of the total length. Observations with a 5-inch theodolite of four pairs of north and south stars gave the latitude of Weti as 5° 3′ 58·3″, with a probable error of 2·9″. This agreed to within 1·5″ with the latitude shown on the Admiralty chart. Trigonometrical triangulation was possible only between the western chain of islands and the west coast of the main island. Very few points could be fixed inland, owing to the lack of prominent hills and the dense vegetation. The thickness of the atmosphere made it very difficult to see the beacons, the only form that proved to be visible being a straight pillar a foot in diameter, 10 to 15 feet in height. At three points stations were constructed by cutting a large tree some 20 feet from the ground, the theodolite being placed on the top of the stem. If a station more than 20 feet high is required, a very large tree must be used, to eliminate swaying of the stem. Away from the west coast it was necessary to replace the triangulation by theodolite traverses across the island, and this involved very heavy clearing, as the lines ran through thick bush, and even in parts through clove plantations. The topography was plotted on the scale of 1 inch to the mile. Here again the unfavourable conditions made ordinary plane-table methods impracticable, and a special procedure was adopted. At the end of the survey, which involved nine and a half months' strenuous labour, an attempt was made to determine the longitude of Chake Chake, the capital, by wireless signals from Zanzibar. This failed, owing to continuous atmospheric discharges, due to thunderstorms, which confused the signals. It even appeared as if the signals themselves provoked atmospheric discharges.

An Expedition into the Southern Interior of Angola has been undertaken by Comte Jacques de Rohan-Chabot, partly, it appears, with a view to sport, partly for exploration of some of the little-known country in the south-eastern portion of the colony. The Count is accompanied by Captain Grimaud, who has charge of the proposed survey work, and Dr. Garnier, who hopes to collect data on the anthropology, particularly on the tribes of Negrito or Bushman affinities. The party landed in Angola last April, and soon afterwards set out for Huilla, where the caravan would be finally organized.

AMERICA.

Mr. Leffingwell's Researches in Arctic North America.—We have already from time to time referred to the work done during the past few years by Mr. Leffingwell on the Arctic coasts of North America (see *Journal*, vol. **33**, p. 215; vol. **36**, p. 615). In a letter written in August, 1911, but not posted at Barrow, Alaska, till last July, he makes a further report of progress in his self-imposed task of survey and geological research along those inhospitable shores. He was then hoping to finish the survey as far as the Colvile river by the time the ice formed, apart from a few bays which he had been forced to skip, as the summer weather is miserable on the coast, and work sometimes almost impossible after the break-up of the ice. He proposed to continue the coast work during the winter, as all his previous attempts to work inland during that season had proved failures. In the spring of 1911 he had been held up in one camp for ten days by a thaw. A "chinook" wind brought the temperature, in February, up to 6·5° C. (43·7° Fahr.), and it rained a little also. The river flooded and the hillsides were as bare as in midsummer. Only a few days later the temperature fell to −47·5° C. (−53·5° Fahr.), the greatest cold he had yet experienced in the field. His double-walled tent, however, enabled him to sleep in comfort, in spite of the oldness of his sleeping-bag. He insists very strongly on the importance of avoiding unnecessary hardships when engaged on work of the kind, and says the misery often experienced by polar travellers can be escaped with the greatest ease by the use of suitable appliances. A *double*-walled tent of light drill is many times as warm as a single one of heaviest canvas, but another necessity is a skin spread under the sleeping-bag —preferably a common sheepskin, though a long-haired winter caribou will serve. This both keeps out wet and adds immensely to warmth. On the geological side he had been working inland from Collinson point, and had secured a good collection of fossils, but had still about 50 to 100 miles at the head of the Canning to examine. At the time of writing he was proposing to come south during the summer of 1912.

Mr. H. G. Bryant in Labrador.—We have received a cutting from the *New York Times* of August 27 last, giving some account of an expedition into the interior of Labrador, carried out this summer by Mr. H. G. Bryant, the well-known President of the Philadelphia Geographical Society, whose acquaintance with the country dates from his visit to the Grand Falls in 1891. The traveller, who had with him Mr. R. W. Porter as topographer, canoemen from Newfoundland, and Indian guides, ascended and mapped the St. Augustine river from the sea to its source, a distance of 141 miles; but the desertion of the Indians made it impossible to reach Hamilton inlet as had been hoped. The country was timbered, but unsuited for agriculture. Mr. Bryant describes the scenery of the central plateau as of surpassing beauty, but the portages were the longest and most difficult in his experience.

The National Parks of the United States.—A first beginning towards the setting apart for public enjoyment of areas of special interest for their scenic beauties or other natural features was made in the United States in 1872 by the creation of the Yellowstone National Park, with an area of over 2,000,000 acres. The praiseworthy example thus set has since from time to time been followed, until quite a number of separate areas have been set apart with the above object, all under the control of the Department of the Interior. The latest example is the Glacier National Park, created by Act of May, 1910, which is situated in Northern Montana, adjacent to the Canadian boundary, and occupying over 900,000 acres. It owes its name to the many glaciers scattered

over its surface—about 80 in all—the largest with an area of 5 square miles. Others of the more recently created parks have likewise a special interest to the geographer, *e.g.* that containing the well-known Crater lake in Oregon, created by an Act of 1902, and the Mesa Verde National Park, set apart in 1906. A useful series of publications regarding the various parks has been issued by the Department of the Interior, giving a general account and sketch-map of each, with brief description of its special features and the regulations laid down for its management, as well as practical information for intending visitors. In the case of certain of the parks further monographs have been prepared by specialists, supplying, for the use of the intelligent lay visitor, a brief account of the geological events to which the present features have been due. Those of this series received down to the present include accounts of the Yellowstone park, Crater lake, and the more important of the small lakes comprised in the Glacier park.

Prof. Parker's last attempt on Mount McKinley.—Prof. Parker's return from his latest attempt to reach the summit of Mount McKinley has lately been announced. He and his companion, Mr. Belmore Brown, are said to have reached Tolvina on the Tanana on July 24, having failed once more to complete the ascent, though their highest point was only some 500 feet below the summit.

POLAR REGIONS.

The Trans-Greenland Expeditions.—Of the two expeditions undertaken this year with a view to the crossing of the inland ice of Greenland (*Journal*, vol. **39**, p. 616), the one, that of the Swiss savant Dr. de Quervain, has already been successfully completed, while the other has been begun under favourable circumstances. A short account of the experiences of the Swiss expedition is given in the *Zeitschrift* of the Berlin Geographical Society, 1912, No. 7. The party was landed at Holstenborg on the south-west coast on April 27, and while the observers who were to carry on work on that coast made the necessary preparations, Dr. de Quervain and his other companions made a trip inland to practise themselves in the use of the sledges and kayaks. On June 1 the whole party proceeded in the direction of Disko island in McClintock's old ship, the *Fox*. In about 69° 45′ a difficult ascent to the margin of the inland-ice was made through the rock-zone. The ice was reached at an elevation of almost 2000 feet, at a spot where it sloped gradually downwards, and was little broken by glacial streams. A preliminary reconnaissance having shown that the surface was favourable for an advance, the final start was made on June 20 with three sledges and twenty-nine dogs. Going soon became more difficult, owing to the watercourses and lakes encountered. The region of *névé* began below 3600 feet, and up to 5250 feet was partly occupied by large lakes, mostly frozen, while crevasses continued to be met with. After crossing the route of Peary (1886) and that claimed to have been followed by Nordenskiöld's Lapps in 1883, the centre of the ice was reached on July 8 at an elevation of 7870 feet. This was not the ice-parting, however, which lay two-thirds of the way across at a height of 8200 feet. On the 17th a hitherto unknown eastern range was sighted, and its highest peak (9090 feet) named Mount Forel. On July 21 the edge of the ice was sighted, and ten days later the expedition safely reached Angmagsalik. Contrary to expectation, the ice-parting did not reach an elevation equal to that found by Nansen further south, nor did the minimum temperature (−9·4° Fahr.) approach that observed by the latter. A communication from Captain Koch, leader of the Danish expedition, with chart of the tracks of the *Godthaab* on the outward and return voyage, appears in the September number of

Petermanns Mitteilungen. While in Iceland for the purpose of securing ponies, the traveller had made a successful trip across the island from south to north, crossing the great ice-cap of the Oræfa and Vatna jökulls. On sailing for Greenland, an attempt to push west through the ice in 76° N. met with difficulties, but in 75° an easy way was found, which led north-west to Cape Bismarck. This was reached on July 21, earlier than had been anticipated, and the difficult task of landing the impedimenta and the sixteen ponies was successfully accomplished. On the return the ship searched for Mikkelsen at Shannon island and Bass rock, only to find that he had already been rescued.

Amundsen's Observations at the South Pole. — Captain Amundsen's observations for the precise determination of his stations in the neighbourhood of the South Pole were handed over by him to the University of Kristiana, in order that the necessary calculations might be carried out. This has been done by Mr. A. Alexander, who had already assisted in the working out of various travellers' observations, including those of Nansen in the *Fram*. An extract from his report is printed in the *Zeitschrift* of the Berlin Geographical Society, 1912, No. 7. The calculations are based on the preliminary value for the longitude of Framheim (163° 37′ W. of Greenwich), but this, as well as the results nearer the pole, may require a slight, but in any case unimportant, future modification. The eighteen altitudes of the sun taken at the first polar station with two sextants give a mean resulting latitude very close to 89° 54′, with a mean error of +2′. A series of bearings of the sun at this station gave the declination, by which the absolute direction of the last day's march was determined, its length being 5½ nautical miles. At the ultimate station, Polheim, observations were taken hourly with one sextant through a complete twenty-four hours, and though the instrument seems to have shown a constant error, while the atmospheric conditions were also anomalous, the effects of these are eliminated by combining the values for the upper and lower culminations. This procedure gives a latitude of 89° 58·6′, and it may be assumed that Polheim lay about 1½ nautical miles from the pole. From this station Helmer Hansen and Bjaaland went 4 nautical miles in the direction supposed to be south on the basis of the above observations; and Mr. Alexander concludes that they must have passed the pole at a distance which might *possibly* amount to 2 kilometres, but which in all probability was not more than a few hundred metres.

Dr. Mawson's Antarctic Expedition.—The *Aurora*, the vessel secured by Dr. Mawson for service in the Antarctic, which will return to Australia in November to bring the leader back, entered Lyttelton harbour on July 16, after completing a winter cruise in eastern sub-Arctic waters. The vessel, according to the *Canterbury Times* (New Zealand) of July 17, sailed from Sydney on May 17, and proceeded by way of Bass strait to the 140th meridian, the journey being made in ten days. Four days were spent in searching for the reported Royal Company islands, and although Captain Davis declares definitely that the islands do not exist where laid down on the chart, it is possible there may be land in the vicinity. The weather, however, was so bad that the sounding machine could not be used, which would probably have given indications of shoaling had land been in the vicinity. On July 8 Macquarie island was reached, where the five men left there by Dr. Mawson were found to be well and doing good work. The "wireless" station was working well, daily weather reports being sent to Melbourne, Hobart, and Wellington. The electricity is generated by a nine-horse power oil engine. The operator believes that his messages are received at the base in Antarctica, but as part of the apparatus is damaged, the

operator there is unable to transmit messages to Macquarie island. Sea elephants were found to be very abundant during the brief stay of the *Aurora* at North-east bay and Lusitania bay. It was thought that these animals had been nearly exterminated. Fierce winds with snow, hail, and frosts were almost incessant, so that no envy was felt for those left behind at the station on June 22. Continued heavy weather accompanied the *Aurora* to the Auckland islands, where anchor was dropped two days later. On July 29 the vessel arrived at Port Ross, remaining there and at Enderby island till July 6, when the course was set for Port Chalmers. Dredging was done in the sheltered harbours of the Aucklands, though two attempts made with the trawl in the open sea were unsuccessful. Valuable collections have been secured for the Canterbury museum, some, like the sea-elephants, being entirely new. One specimen obtained is nearly 17 feet long, and weighed, when alive, considerably over a ton. The weather during the cruise was even worse than usual in a high southern latitude in the winter season, and Captain Davis says that the way his old whaler weathered the gales speaks much for her staunchness and seaworthiness. Owing to the practical absence of daylight in so high a latitude in mid-winter, no cinematograph work could be done.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Tests of the Vicinity of Icebergs.—Since the loss of the *Titanic* much attention has been paid to the microthermometer invented by Prof. Barnes (cf. *Journal*, September, p. 339), by which its inventor claims to be able to give timely warning of the presence of icebergs. He is understood to be continuing his experiments; meanwhile there is a disposition in some quarters to question the value of the temperature test and to seek for other means of obtaining the desired warning. Dr. M. Coplans, bacteriologist to the city of Leeds, is understood to have elaborated a new apparatus for recording the electrical conductivity of sea-water, from which he hopes much in the direction indicated, since the presence of icebergs is known to sensibly influence such conductivity. Dr. Coplans lately sailed for Canada in order to carry out experiments in the area liable to ice, with the co-operation of the Canadian and United States governments. It is stated that one of the most important uses of the apparatus will consist in the power it will give of detecting bacterial impurities in drinking-water.

Land and Water on the Earth's Surface.—The publication two years ago, by A. Baldit,* of the results of a new measurement of the land and water areas on the surface of the globe, has suggested to Dr. H. Wagner a comparison of the new results with those previously given, on the one hand by Krümmel in his 'Handbuch der Ozeanographie,' (1907), and on the other by himself in his 'Lehrbuch der Geographie' (1908), the latter being repeated (with corrections) from the original estimates put forward in the *Beiträge zur Geophysik*, 1895. Such a comparison is made in the August number of *Petermanns Mitteilungen* for the present year. Baldit's calculations were made by zones, not of 10° or 5°, as in previous cases, but of 1°, and as his methods also differed from those of his predecessors, the chief value of his results lies in the opportunity of independent control afforded by them. The fact that he uses the spheroid of Faye instead of that of Bessel, involving a total difference of

* "Sur la répartition des Terres et des Mers à la surface du Globe" (*Ann. Bur. Centr. Météorologie, Mém. de* 1906, Paris, 1910).

66,000 square kilometres (25,484 square miles) in the total area of the surface, is of comparatively little importance when the results are rounded off to even 10,000's. As, however, Baldit used an out-of-date estimate of the proportions of land and water in the extreme north and south, the comparison, to have any value, must be made for the better known parts of the surface between 80° N. and 60° S. This Dr. Wagner does in two tables, the one showing the actual figures obtained by each of the three workers for ten-degree zones, the other the percentages of each for the same zones. He points out that the agreement between his own figures and Baldit's is generally close, amounting to 0·1 per cent. in two zones only; and for these two, Krümmel's figures appear to lend support to his own as against Baldit's results. As regards the whole surface between 80° N. and 60° S. the percentages obtained by the three authorities vary inappreciably, Wagner showing 28·5 per cent. of land, the other two 28·4 per cent. The *total* land area within those latitudes is given by Baldit, however, as 550,000 square kilometres less than Wagner's figure. With the necessary corrections to Baldit's estimate for the extreme north and south, the results for the whole surface of the globe appear as follows: Land, 149,000,000 sq. kilom. (57,500,000 sq. miles); water, 361,000,000 sq. kilom. (139,400,000 sq. miles); or 29·22 and 70·78 per cent. respectively. This gives the proportion of land to water as 1 : 2·42.

HISTORICAL GEOGRAPHY.

The Life-work of Prince Henry the Navigator.—In an article contributed to the *American Historical Review* for January last, a reprint of which has been sent us by the author, Prof. Beazley presented the final results of studies on the work of Prince Henry of Portugal, on which he had been engaged for some time. In the *Journal* for December, 1910, he attempted a new appreciation of the geographical aspects of the Prince's labours, showing (recent belittling tendencies on the part of certain writers notwithstanding) what an important part the furtherance of scientific and geographic knowledge played in all his schemes and enterprises. In the *American Historical Review* for October, 1910, the *rôle* of the Prince as the leader of a great crusading movement, no doubt the most important of all, at least to the minds of his contemporaries, was kept in the foreground. The latest contribution is concerned with the Prince's political, commercial, and colonizing work, thus completing an instructive review of the various motives underlying the Prince's epoch-making activities. The studies inspire confidence from the pains taken to substantiate every conclusion by an appeal to the best first-hand authorities, and their value consists largely in the copious references given throughout, not only to passages in the published works of chroniclers, but to documents preserved in the Lisbon Archives, to many of which Prof. Beazley has for the first time called attention. In the last of the series, it is shown how the Prince was a Portuguese statesman and general who more than any other helped to guide his country to an Imperial position; how it was his constant aim to open fresh fields for his country's trade—a policy crowned with considerable success even before the Portuguese voyages had been pushed beyond the Guinea coasts; and how, lastly, the earliest of modern European colonial empires began to take shape under his leadership through the settlements formed in the various Atlantic islands. Though treating separately of each of these various phases of Prince Henry's work, Prof. Beazley would probably admit that the motives which actuated him cannot be altogether disentangled. As a champion of Christianity against Islam he would

also be serving his country's political interests, and the same may be said of the commercial ventures, the profits of which would equally raise the status of Portugal among the nations of Europe.

OBITUARY.

Admiral Sir R. Vesey Hamilton, G.C.B.

ADMIRAL SIR RICHARD VESEY HAMILTON has passed away after a long life of strenuous and most useful work, both as a naval officer and a geographer.

Born in 1829, the son of the Rector of Little Chart in Kent, Hamilton passed his boyhood in Kent, a good deal at Sandwich, and was educated at the Naval School, which was then at Camberwell. In July, 1843, he entered the Navy on board the *Virago*, and was two years in her, serving in the Mediterranean under Sir George Otway. He was then, for a year, in the *Valetta* with Captain Brock, learning the theory and practice of marine surveying. Three months in the old *Rodney*, and two years in the *Spartan* completed his time; and in 1850, after service on board the *Excellent*, he had passed his examinations, and volunteered for the Arctic Expedition, which was fitting out at Woolwich, for the search of Sir John Franklin's ships.

Hamilton was appointed a mate on board the *Assistance*, Captain Ommanney, and he had, among his messmates, McClintock and Mecham as first and second lieutenants, by far the two greatest among Arctic travellers, Sir James Donnet, the late Dr. Charles Ede, and the present writer. In those days Hamilton was a very zealous young officer, an excellent sailor, lithe and active, with a head well stored with knowledge, but extraordinarily modest and unselfish. As a watch-keeper he was reliable, and during the forty days that the old *Assistance* was fighting her way through the ice floes in Melville Bay, he was most efficient, quick to see what was needed and to act, among the foremost in all hard work and in encouraging the men. During the Arctic winter his geniality, even temper, and great fund of anecdote were most welcome. In the travelling he commanded Sherard Osborn's depôt sledge, the "Adventure," with the sawn tree of the Hamiltons as his flag. He reached Cape Walker, was away twenty-eight days (April 15 to May 13), and surveyed Lowther and Young islands on his way back.

On the return of the *Assistance*, Hamilton was promoted to the rank of lieutenant, and at once volunteered for the next expedition under Sir Edward Belcher. He was appointed to the *Resolute*, Captain Kellett, with his old friend Mecham as first lieutenant, and McClintock as Commander of the tender *Intrepid*. The two vessels reached Melville island and wintered on its southern coast. Arctic travelling was then carried to its extreme limit without dogs, while dogs were used in their proper place, for keeping up communications.

Hamilton's sledge was the "Hope," the sledge flag white with a rising sun. He discovered the northern end of Melville Island, called Sabine peninsula, and two off-lying islets named Vesey Hamilton and Markham. The captain of his sledge was that grand old sailor, George Murray, who wielded his pen as well as he dragged a sledge. All went well, and Hamilton's party returned after an absence of fifty-four days, having gone over 663 miles, and made an important geographical discovery.

Hamilton then entered upon his third Arctic winter; and, among other useful

services, he established an electric telegraph between the *Resolute* and *Intrepid*, giving instruction in the working, and reading off. Early in March it became necessary to communicate with Sir Edward Belcher in the *Assistance*, and then the proper work for dogs had to be performed. Hamilton started with two men and nine dogs on March 8, 1854, and made 25 miles a day, returning with despatches. In June he made another journey to Melville island with dogs, returning the whole distance to the *North Star* at Beechey island. He was for a short time acting Commander of the *Pioneer*.

When the expedition returned the Crimean War had already broken out, and Hamilton served in the Baltic campaign on board the steamer *Desperate*, from January, 1855, to February, 1856. His next service was in China. He took out the gun-boat *Haughty* from England, and saw much active work in her, including the battle of Fatshan, for which, many years afterwards, he was created a C.B. In 1857, aged 28, he was promoted to the rank of Commander.

From 1858 to 1862 Hamilton commanded the *Hydra* on the North American Station, and had opportunities of collecting much geographical information, both in the ascent of the Orinoco as far as Bolivar, and on the coast of Labrador, and in 1862 he was promoted to the rank of Post-Captain.

It was then that he attained what he had long wished for, the hand of Julia Frances, daughter of Vice-Admiral J. A. Murray (great-grandson of the third Duke of Atholl), and of Julia, daughter of J. Delmé of Cams Hall, near Fareham. But his services were always in request. He was married in December, 1862, and almost immediately he received the command of the *Vesuvius* for service at the Newfoundland fisheries until 1864. His next command was the *Sphinx*, 1865 to 1867, and in 1868 to 1869 he was a Member of the Ordnance Select Committee. In the latter year he became a Fellow of this Society, and served several times on our Council.

In 1870 to 1873 Hamilton had the *Achilles* at Weymouth, from 1873 to 1875 he was in charge of the steam reserve at Plymouth, and in 1875 to 1877 he was Captain Superintendent of Pembroke Dockyard, attaining the rank of Rear-Admiral in the latter year.

He had been pressed to volunteer for the command of the Arctic Expedition of 1876, but he refused on the ground of age, reminding those who urged him how very different their opinions were about age, when they were a quarter of a century younger. Of course he was ready to undertake it, if it was offered to him, but he would not volunteer.

Hamilton's services were as much sought for on shore as afloat. He was Director of Naval Ordnance from January, 1878, to April, 1880, and Commander-in-Chief at Queenstown from 1880 to 1883. He was then employed on shore again, on the Home Defence and other Committees. From 1885 to 1888 he was Commander-in-Chief on the China Station, and was created a K.C.B. in June, 1887. At this period one striking trait in Sir Vesey Hamilton's character was brought to bear with good effect. Modest almost to a fault, when he was once quite convinced that a course he was taking was right, nothing could make him swerve until the object was gained. He found that the officers and men under his command, especially the junior officers and men, were suffering injustice owing to a practice of the Treasury. He represented the matter to the Admiralty, and it was submitted to the Treasury. But that Department declined to alter their practice, so the Admiralty informed the admiral on the China Station that nothing more could be done. Sir Vesey did not concur. On his return from China he tackled the Treasury directly, and with such persistence that, in the end, he gained his point.

From 1889 to 1891 Sir Vesey Hamilton was First Sea Lord of the Admiralty, where he consistently held that no expediency, no question of policy could justify the swerving a hair's breadth from what was right. He wrote the little volume on naval administration, and his ability and love of justice and fair play were fully appreciated. His last command was at Greenwich where he presided over the college from 1891 to 1894. He was created a Knight Grand Cross of the Bath in 1895, having retired in the previous year after an almost continuous service to his country of more than fifty years.

Sir Vesey Hamilton's interest in geographical work, and especially in all that related to polar exploration, continued to the last. He was an active member of the United Service Institution, and took a very special interest in the Navy Record Society, serving on its Council. He was for some years, from 1898 to 1903, occupied in the congenial but onerous task of editing the letters and papers of Sir T. Byam Martin for the Navy Record Society, which he completed with his usual care and sound judgment.

Lady Hamilton died on June 4, 1897, after a happy married life of thirty-five years. The admiral was left with four children, two sons and two daughters, and he passed the last years of his life in a pleasant retreat at Chalfont St. Peter, near Uxbridge.

Sir Vesey took a deep interest in the progress of Antarctic discovery. Indeed he was the first to bring the subject forward, by a paper and discussion on the apocryphal voyages of Captain Morrell. It was at the time when Captain Davis was proposing Sabrina island for observing the transit of Venus. The admiral served on the Executive and Ship Committees of the Society's Antarctic Expedition, when his advice and help were invaluable. He was extremely well read, and had plenty to occupy and interest him in his retirement. To the last he was eager to help any old shipmate whose needs were brought to his notice. Sir Vesey had been ill during the summer, but his end was rather sudden. He died at his house in Chalfont St. Peter on September 17, aged 83, and was buried at Eltham on the 23rd. His Majesty the King, the Admiralty, the Royal Geographical Society, and the Navy Record Society were represented at the funeral.

There passed from among us an officer of a very fine type, a steadfast seeker after the right, the Father of Arctic discovery, an accomplished geographer, a true and loyal friend.

C. R. M.

Clinton Thomas Dent, F.R.C.S., M.C. Cantab., etc.

The premature death of Clinton Dent, at the age of 61, takes away from among us a personality which will be grievously missed, not only by his professional colleagues, but also by his many friends in the different walks of life on which he touched.

Dent was a man whose devotion to his profession did not stand in the way of his many tastes and accomplishments. He was an expert in most games of skill that call for dexterity; he could draw himself, and was the helpful friend of many artists. Like his fellow-traveller Donkin, he was an admirable photographer, and showed his artistic sense in his choice and arrangement of subjects. But what gave a particular value to Dent's friendship was his right judgment. In any delicate or difficult matter, public or private, his opinion never failed to carry weight, for those who asked it knew that it was the outcome of critical powers of unusual subtlety, carefully and judicially exercised. In the happy words used by the Commissioner of Police in the announcement of his death issued to the force, he was at all times an "able and fearless counsellor."

Clinton Dent was educated at Eton and Cambridge. Ample means rendered him independent of the rewards of a private practice. But they were no impediment to the professional exercise of his acute mind and untiring energies. These were always in the first place at the service of the great hospital with which he became connected. At the time of his death he was senior surgeon of St. George's Hospital. He was also President of the surgical section of the Royal Society of Medicine, and Vice-President of the Royal College of Surgeons. For many years he was surgeon to the Belgrave Hospital for Children, the removal of which to a new and adequate building in South London was mainly due to his influence and liberal help. In 1904 he undertook the responsible duties of Chief Surgeon to the Metropolitan Police, a post he found thoroughly congenial to him. He was a honorary M.C. of the University of Cambridge. Too much of a critic and a student to share the common craving for popular recognition and consequent honours, he achieved the latter by the simple but arduous method of doing his best in all that came under his hands. Despite a fastidious temperament which led him, much to his colleagues' regret, to leave many of his medical lectures unprinted, he made large and important contributions to the literature of surgery.

But it is with Clinton Dent's employment of the holidays of a full and arduous career that we are chiefly concerned here. If not a traveller in the fullest sense of the term he was in the front rank of "Vacation Tourists" (to borrow Mr. Galton's term) and of mountaineers. He was the first to climb, after no fewer than eighteen failures, the most famous of the Aiguilles of Mount Blanc, the Aiguille Dru. He made many other Alpine expeditions, some of which are recorded in a delightful volume, now become scarce, "Above the Snowline." His love of mountaineering led him three times, in 1887, 1889 and 1895, to the Caucasus. In the first visit with his friend, Mr. Donkin, he made explorations in the central group and climbed Gestola, 15,920 feet. In 1889, with Mr. H. Woolley, myself, and the late Dr. Andreas Fischer (who fell a victim to the storms of this inclement summer on the Aletschhorn), he went out to search for traces of the fate that had overtaken Mr. Donkin and Mr. Fox with their guides, one of whom was Fischer's brother, in the previous year. The successful result was recorded in this *Journal*. In the course of our travels we found ourselves more than once in positions where I had full opportunity of recognizing Dent's qualities as a climber and a fellow-traveller. Caucasian travel is full of trials of temper, but I only once saw Dent lose his patience, and that was when one of our Swiss companions celebrated his partial recovery from an attack of dysentery by a voracious attack on hard cheese. In 1905, with Mr. H. Woolley, he climbed and explored round the sources of the Urukh. Dent partly wrote, but never brought out a book on his Caucasian experiences. It is to be hoped that any portion that exists may yet be published, for all Dent wrote was full of life and humour. He also edited the *Badminton* volume on "Mountaineering," and wrote many of its chapters.

Dent was an able and entertaining lecturer, and his after-dinner speeches did much to maintain the reputation the Alpine Club had acquired in that respect under Leslie Stephen and Crawford Grove. Of the Club to which he was devoted, Dent was in turn Honorary Secretary (1878–88) and President (1887–89). He sat on the Council of our Society from 1898 to 1902. Dent was never married.

D. W. F.

Admiral of the Fleet Sir Frederick W. Richards, G.C.B.

This distinguished Admiral, whose death occurred at the end of September, had been a Fellow of this Society since 1874, and though his brilliant record did not include any direct contributions to geographical knowledge, he was keenly

interested in geographers and their work, and was a frequent attendant at the dinners of the Geographical Club. Sir Frederick had seen a good deal of service on foreign stations, particularly on the African coasts and in the East Indies, of which he therefore possessed a close personal knowledge. His first service on the West Coast of Africa dated from 1862–65, during which years he commanded the gun-vessel *Dart*. In 1878 he became Commodore on the West African station, and his presence at the Cape at the time of the disaster at Isandhlana led to his taking part in the subsequent occurrences on the south-east coast. With a small force of bluejackets he himself marched inland and shared in such operations as the relief of Eshowe and the fight at Laing's Nek. His last foreign service was as Commander-in-chief in the East Indies, 1885–88. Of his subsequent record at home, including his seven years' tenure of the post of First Naval Lord of the Admiralty, this is not the place to speak particularly.

Captain A. W. Stiffe.

We regret to record the death of Captain Arthur William Stiffe, late I.N., which occurred suddenly at Goring-on-Thames on August 14 last, just after the completion of his eighty-first year. Captain Stiffe joined the Society in 1894, and he was well known to readers of the *Journal* as the author of various papers on the regions bordering on the Persian gulf, whose ancient trading centres he described from first-hand knowledge acquired during his long association with that part of the world.

Entering the Indian Navy as a midshipman in 1849, he took part in the Persian war of 1856–57, and was actively employed on hydrographic surveys, both in the Persian gulf and on the Makran coast, and also on the coast of Western India. The results were embodied in new charts and sailing directions. During furlough in England he gave a striking example of zeal and enterprise by qualifying himself as an engineer under the distinguished James Abernethy. Returning to India in 1863, he was appointed, on the abolition of the Indian Navy, to the Royal Indian Marine, and served for a short time on the Arabian coast; but he soon afterwards took charge, as engineer-in-chief, of the cables then being laid by the Indian Government in the Persian gulf. He prosecuted the work with such energy and zeal that the through route from India to this country was opened for traffic by way of Turkey in 1865. He remained in the gulf attached to the telegraph service some years longer, but in 1879 became Port Officer and Superintendent of Marine at Calcutta—posts of much responsibility in connection with the dangerous navigation of the Hugli. He made a special study of the estuary and published an important memoir thereon, which is still regarded as authoritative. Retiring under the age-limit in 1888, he two years later undertook the responsible task of laying the Halifax-Bermuda cable, which he successfully carried out. Of late years he had lived in London, maintaining his varied intellectual interests to the last. He married in 1863, and had two sons and a daughter.

Daniel Walter Kettle.

By the death of Mr. Daniel Walter Kettle, which took place at Bexley Heath on September 16, at the age of 63, the Society has lost one of its older Fellows, he having joined it in 1875, and the geographical world is the poorer. A grandson of Mr. Alexander Findlay, one of the first Fellows of our Society, he received his early hydrographical training from his uncle, Mr. Alexander George Findlay, who was an active member of our Council for some years. On the death of Mr. A.

G. Findlay in 1875, he continued to carry on the nautical publishing firm of R. H. Laurie, which was founded early in the eighteenth century, and with great ability projected and published a fine series of new charts, while keeping the older publications of the firm in a reliable and efficient state. This he did continuously and successfully for nearly a third of a century, till the increasing responsibility of keeping their works abreast of the increased demands of more modern scientific navigation, rendered it advisable for the three separate firms of chart publishers to combine their forces in the one firm of Imray, Laurie, Norie & Wilson, Ltd., early in the twentieth century.

To his valuable but yet unobtrusive services the navigator can bear testimony in all parts of the world, and he was content if his work met with approval from those who used and profited by it.

By his will he bequeathed to the Society a valuable astronomical regulator clock, once the property of the eminent geographer, the late Mr. John Arrowsmith.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Bonney.**

The building of the Alps. By Prof. S. G. Bonney. London: T. Fisher Unwin. 1912. Size 9 × 6, pp. 384. *Illustrations and Sections. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Austria—Coast—Geology. **Schubert.**

Geologischer Führer durch die Nördliche Adria. Von Dr. Richard Schubert. (Sammlung geologischer Führer, xvii.) Berlin: Gebr. Borntraeger, 1912. Size 6½ × 4, pp. viii. and 214. *Sketch-map, Sections, and Illustrations. Price M.*4.80.

Austria—Tirol. **Clare.**

The Brenner Pass: Tirol from Kufstein to Riva. By Constance Leigh Clare. London: J. & J. Bennett, 1912. Size 9 × 6, pp. 310. *Sketch-map and Illustrations. Price 6s. net. Presented by the Publishers.*

France—Road. *B.S.G. Lille* **57** (1912): 206–213. **Justice.**

La Nouvelle route des Alpes. Par Octave Justice. *Illustrations.*

On the newly opened road affording uninterrupted communication along the whole length of the French Alps, from the Lake of Geneva to the Mediterranean.

Germany—Geology. *Z. Gletscherkunde* **6** (1912): 250–277. **Werth.**

Die äussersten Jungendmoränen in Norddeutschland und ihre Beziehungen zur Nordgrenze und zum Alter des Löss. Von Dr. E. Werth. *Map.*

Germany—Main basin. **Mordziol**

Geologischer Führer durch das Mainzer Tertiärbecken. Von Dr. C. Mordziol. I. Teil. (Sammlung geologischer Führer, xvi.) Berlin: Gebr. Borntraeger, 1911. Size 6½ × 4, pp. xii. and 168. *Sections and Illustrations. Price M.5.60.*

Germany, North. **Tacke and Lehmann.**

Die Norddeutschen Moore. Von Bruno Tacke und Bernhard Lehmann. (Land und Leute: Monographien zur Erdkunde . . . herausgegeben von Ernst Ambrosius, No. 27.) Bielefeld, &c.: Velhagen & Klasing, 1912. Size 10 × 7, pp. iv. and 148. *Maps and Illustrations. Price M.4.*

Germany—Odenwald. **Klemm.**

Führer bei geologischen Exkursionen im Odenwald. Von Prof. Dr. G. Klemm. (Sammlung geologischer Führer, xv.) Berlin: Gebr. Borntraeger, 1910. Size 6½ × 4, pp. viii. and 248. *Illustrations. Price M.6.50.*

Germany—Pomerania—Madü-See. **Halbfass.**

Internat. Rev. Hydrobiologie, Hydrographische Suppl. **1** (1910–11): (No. 1) pp. 40.

Gibt es im Madüsee Temperaturseiches? Von Prof. Dr. W. Halbfass. *Chart and Diagrams.*

Germany—Prussia—Coast. **Friederichsen.**

Vorpommerns Küsten und Seebäder. Von Dr. Max Friederichsen. Greifswald, Bruncken & Co., 1912. Size 9 × 6, pp. 64. *Maps, Illustrations, and Diagrams. Presented by the Author.*

Hungary—German Language. *Deutsche Erde* **9–10** (1910–11): *passim.* **Pfaundler.**

Das Verbreitungsgebiet der deutschen Sprache in Westungarn. Von Dr. Richard Pfaundler. *Maps.*

Hungary—Transylvania—Geomorphology. **Sawicki.**

Beiträge zur Morphologie Siebenbürgens. Von L. Sawicki. (Extrait du *Bulletin* de l'Académie des Sciences de Cracovie, Classe des Sciences Mathématiques et Naturelles. Série A: Sciences Mathématiques, Février, 1912.) Cracow, 1912. Size 10 × 6½, pp. 130–265. *Maps, Sections, and Illustrations.*

Italy. **Sully.**

Italian travel sketches. By Dr. James Sully. London: Constable & Co., 1912. Size 8½ × 5½, pp. x. and 326. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Italy—Liguria. **Lees.**

Wanderings on the Italian Riviera: the record of a leisurely tour in Liguria. By Frederic Lees. London: Sir J. Pitman & Sons, 1912. Size 8 × 5½, pp. xvi. and 350. *Sketch-map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Russia—Urals. **Backlund.**

Mém. A. Imp. Sc., St. Petersbourg, Classe Phys.-Math. **28** (1911): (No. 1) pp. vi. and 124.

Résultats scientifiques de l'Expédition des frères Kuznetzov à l'Oural Arctique en 1909, sous la direction de H. Backlund. *Map, Diagrams, Sections, and Illustrations.* [In Russian.]

See note in vol. 39, p. 69.

Spain—Catalonia and Balearic Isles. **Maheu.**

Spelunca **8** (1912): No. 67–68, pp. 108.

Exploration et flore souterraine des cavernes de Catalogne et des iles Baléares. Par Jacques Maheu. *Sketch-maps and Illustrations.*

Spain—Leon—Bierzo. *B.R.S.G. Madrid* **54** (1912): 197–229. **Rey.**

Una excursión en el Bierzo. Errores geográficos y conjeturas históricas. Por el Capitán Garcia Rey.

Sweden—Earthquakes. **Sahlström.**

Sveriges Geol. Undersökning, Ser. C, No. 238 (1911): (*Årsbok*, 1910, No. 10): pp. 96.

Jordskalf i Sverige, 1907–1910. Af K. E. Sahlström. *Maps.*

Sweden—Hydrology. **Hydrografiska Byrån.**

Hydrografiska Byrån: Arsbok 2, for år 1910. Stockholm, 1912. Size 12 × 9½, pp. viii. and 178. *Maps and Illustrations.*

Sweden—River. **Geer.**

Sveriges Geol. Undersökning, Ser. C, No. 236 (1911): (*Årsbok*, 1910, No. 8): pp. 198.

Klarälfvens serpentinlopp och flodplan. Af Sten De Geer. *Maps, Diagrams, and Illustrations.*

Switzerland—Geology. **Staub.**

Beiträge Geol. Karte Schweiz **32** (1911): pp. viii., 84, and xiv.

Geologische Beschreibung der Gebirge zwischen Schächental und Maderanertal im Kanton Uri. Von Walther Staub. *Maps and Sections.*

Switzerland—Ice Age. *Beiträge Geol. Karte Schweiz* **31** (1911): 27–36. **Blösch.**

Die grosse Eiszeit in der Nordschweiz. Von Dr. Ed. Blösch. *Section.*

Turkey—Historical. *Mouvement G.* **29** (1912): 313–316. **Wauters.**

Le partage de la Turquie. Par A. J. Wauters. *Sketch-map.*

United Kingdom—Buckingham—Geology. **Sherlock and Noble.**

Quart. J. Geol. S. **68** (1912): 199–212.

On the glacial origin of the clay-with-flints of Buckinghamshire and on a former course of the Thames. By Dr. Robert Lionel Sherlock and Arthur Henry Noble. *Map and Illustrations.*

United Kingdom—Ireland. **[Murray.]**

[Murray's] Handbook for travellers in Ireland. 8th edit., revised and edited by John Cooke. London: E. Stanford, Ltd., 1912. Size 7 × 4½, pp. x., 66, and 604. *Maps and Plans. Price* 9*s. Presented by the Publishers.*

United Kingdom—Ireland—Archæology. **Coffey.**

New Grange (Brugh na Boinne) and other incised tumuli in Ireland. The influence of Crete and the Ægean in the extreme West of Ireland in early times. By George Coffey. Dublin: Hodges, Figgis & Co., 1912. Size 10 × 6½, pp. xii. and 118. *Plans and Illustrations. Price* 6*s. net. Presented by the Publishers.*

United Kingdom—Radnor. **Davies.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Radnorshire. By Lewis Davies. Cambridge: University Press, 1912. Size 7½ × 5, pp. xii. and 156. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. net. Presented by the Publishers.*

ASIA.

Ceylon—Survey. **Warren and Templeton.**

Ceylon. Survey Department. Administration reports, 1909. Part i.—Civil. Survey. Report of Mr. P. D. Warren. Size 13 × 8½, pp. 24. *Maps.*
The same for 1910–11. Report of Mr. R. S. Templeton. Size 13 × 8½, pp. 16. *Maps and Illustrations. Presented by the Surveyor-General.*

China. **Macgowan.**

Men and manners of modern China. By J. Macgowan. London: T. Fisher Unwin, 1912. Size 9 × 5½, pp. 352. *Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Chinese Empire—Manchuria. **Farrar.**

Plague in Manchuria. By Dr. Reginald Farrar. (Reprinted from the *Proceedings* of the Royal Society of Medicine, 1911. Vol. 5 (Epidemiological Section).) London, 1911. Size 10 × 7, pp. 14. *Sketch-map and Diagram.*

Includes a study of the means by which the plague was diffused through the country.

French Indo-China—Ruins. *National G. Mag.* **23** (1912): 209–272. **Conner.**

The forgotten ruins of Indo-China. The most profusely and richly carved group of buildings in the world. By Jacob E. Conner. *Illustrations.*

India—Assam. **Shakespear.**

The Lushei Kuki Clans. By Lieut.-Colonel J. Shakespear. Published under the orders of the Government of Eastern Bengal and Assam. London: Macmillan & Co., 1912. Size 9 × 5½, pp. xxii. and 250. *Map and Illustrations. Price* 10*s. net. Presented by the Publishers.*

India—Cotton growing. ——

The British Cotton Growing Association, No. 50, 1912. Correspondence *re* cotton growing in India. Manchester, 1911. Size 8½ × 5½, pp. 30.

India—Ganges Delta. *J. and P. Asiatic S. Bengal* **6** (1910): 543–556. **Ascoli.**

The rivers of the Delta. By F. D. Ascoli. *Also separate copy, presented by the Author.*

See note in the June number (1912), p. 611.

India—Himalaya. **Collins and Wyatt.**

Exploration in the Himalaya. Determination of the positions and heights of the Teram Kangri Peaks. [By V. D. B. Collins and B. T. Wyatt.] (Type-written Report: India Office, April, 1912.) Size 13 × 8½, pp. 4.

The results of these determinations were reported in the *Journal*, vol. **39**, p. 71.

India—Historical. *J. and P. Asiatic S. Bengal* **6** (1910): 527–542. **Hosten.**

List of Jesuit Missionaries in "Mogor" (1580–1803). By Rev. H. Hosten.

India—N.W. Frontier. **Wylly.**

From the Black Mountain to Waziristan; being an account of the border countries and the more turbulent of the tribes controlled by the North-West Frontier Province, and of our military relations with them in the past. By Colonel H. C. Wylly. London: Macmillan & Co., 1912. Size 9 × 5½, pp. xvi. and 506. *Maps. Price* 10*s.* 6*d. net. Presented by the Publishers.*

India—Punjab. **Young.**

Scinde in the forties; being the journal and letters of Col. Keith Young, sometime Judge-Advocate-General in India. Edited by Arthur F. Scott. London: Constable & Co., 1912. Size 9½ × 6½, pp. xvi. and 202. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

India—Survey and Research. **Board of Scientific Advice.**

Annual Report of the Board of Scientific Advice for India for the year 1910–11. Calcutta, 1912. Size 10 × 7, pp. 200. *Price* 1*s.* 6*d.*

See October number, p. 440.

Japan—Formosa—Flora. **Hayata.**

Icones Plantarum Formosanarum nec non et Contributiones ad Floram Formosanam, or, Icones of the plants of Formosa, and materials for a flora of the Island, based on a study of the collections of the Botanical Survey of the Government of Formosa. By B. Hayata. Fasciculus I., 1911. Published by the Bureau of Productive Industry. Taihoku, 1911. Size 10½ × 7½, pp. 266. *Illustrations.*

Japan—Historical. *T'oung Pao* **13** (1912): 204–290. **Cordier.**

Le premier traité de la France avec le Japon. (Yedo, 9 Octobre, 1858.) Par Henri Cordier.

Japan—Hokkaido—Coal. ——

Japan. Report on the coal-mining industry in the Hokkaido. (Diplomatic and Consular Reports, Misc. Series, No. 682, 1912.) London, 1912. Size 10 × 6, pp. 32.

Noticed in the Monthly Record, *ante*, p. 562.

Persia. **Shuster.**

The strangling of Persia: a record of European diplomacy and Oriental intrigue. By W. Morgan Schuster. London: T. Fisher Unwin, 1912. Size 9 × 6, pp. 378. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

Turkey—Asia Minor—Historical. **Leaf.**

Troy: a study in Homeric geography. By Dr. Walter Leaf. London: Macmillan & Co., 1912. Size 9 × 6, pp. xvi. and 406. *Maps, Plans, and Illustrations. Price* 12*s. net. Presented by the Author.*

AFRICA.

British East Africa. **Cranworth.**

A colony in the making; or, Sport and profit in British East Africa. By Lord Cranworth. London: Macmillan & Co., 1912. Size 9 × 6, pp. xiv. and 360. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

Cape Colony. **Railway Department.**

Cape Colony to-day (2nd edit.). Issued by the Cape Government Railway Department. Cape Town, 1909. Size 9½ × 7, pp. viii. and 278. *Sketch-map and Illustrations. Presented by the High Commissioner for South Africa.*

Egypt—Eastern Desert. *Cairo Sc. J.* **6** (1912): 69–71. **Hume.**

Geological expedition into the Eastern Desert. By Dr. W. F. Hume.

See note in the August number, p. 215.

Egypt—Geology. **Hume.**

Ministry of Finance, Egypt. Survey Department. Explanatory notes to accompany the geological map of Egypt, with tables showing distribution of geological formations and economic products. By Dr. W. F. Hume. Cairo, 1912. Size 10 × 7, pp. 50. *Sections.*

Egypt—Kharga Oasis. *Smithsonian Misc. Coll.* **59** (1912): No. 1, 1–118. **Hrdlička.**

The natives of Kharga Oasis, Egypt. By Dr. Aleš Hrdlička. *Illustrations, Diagrams, and Sketch-map.*

Egypt—Siwa—Meteorology. *Cairo Sc. J.* **6** (1912): 76–84. **Kasim.**

A meteorological expedition to Siwa. By Mohammad Kasim. *Illustrations.*

Egypt—Tor. *Cairo Sc. J.* **6** (1912): 113–119. **Comissopulos.**

Tor. The village — the quarantine station—the meteorological station. By N. A. Comissopulos. *Illustrations and Diagrams.*

Egypt and Sudan—Evaporation. *Cairo Sc. J.* **6** (1912): 103–107. **Craig.**

Evaporation in Egypt and the Sudan.

Egyptian Sudan—Cotton. **Hutton.**

The British Cotton Growing Association. No. 49, May 1912. Cotton growing in the Anglo-Egyptian Sudan. Mr. J. A. Hutton on the recent journey. Manchester, 1912. Size 8½ × 5½, pp. 30. *Sketch-map.*

French Equatorial Africa. *B.S.G. Marseille* **35** (1911): 342–360. **Mercier.**

Le pays du Logone-Chari. La voie de la Bénoué. Par Capitaine Émilien Mercier.

French Equatorial Africa. **Martin.**

Capt. Maurice Martin. Au cœur de l'Afrique Equatoriale (journal de route d'un officier). Lille: Impr. Lefebre-Ducrocq, 1912. Size 8 × 5, pp. viii. and 216. *Sketch-map and Illustrations. Presented by the Author.*

Narrative of a mission (of which the writer was second in command) to the Banda countries and the districts adjoining the Anglo-Egyptian Sudan.

French Equatorial Africa—Ba-Kalè. **Avelot.**

Notes sur les pratiques religieuses des Ba-Kalè. Par le Capitaine R. Avelot. (Extrait des *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, October 1911.) Paris, [1911]. Size 10 × 6½, pp. 283–298. *Sketch-map and Illustrations.*

German East Africa. *M.G. Ges. Hamburg* **26** (1912): 108–132. **Obst.**

Die Landschaften Issansu und Iramba. (Deutsch-Ostafrika.) Von Dr. E. Obst. *Illustrations.*

German East Africa—Altitudes. **Fromm.**

M. Deuts. Schutzgebieten **25** (1912): 101–102.

Höhenbestimmungen in Deutsch-Ostafrika von Hauptmann L. Fromm. Berechnet von Wedemeyer.

Portuguese West Africa. **Lima.**

Alguns trechos do relatorio do Engenheiro Rego Lima sobre a sua missao ás minas de Cassinga em 1898. Reunidos e publicados postumamente por Francisco Luiz Pereira de Sousa. (Extracto da Revista de Engenheria Militar.) Lisbon, 1911. Size 9½ × 6½, pp. 248. *Maps.*

The mines in question lie to the east of the upper Kunene.

South Africa—Tonga. **Junod.**

The life of a South African tribe. By Henri A. Junod. I. The social life. London: D. Nutt, 1912. Size 9 × 6, pp. 500. *Map and Illustrations. Price* 8*s.* 6*d. Presented by the Publisher.*

Embodies the results of careful inquiries during missionary labours among the Tongas or Thongas of South-East Africa.

NORTH AMERICA.

Canada—Hudson bay. *P. and T.R.S. Canada* **5** (1911): Sect. I., 119–165. **Prud'homme.**
La Baie d'Hudson: Notes Préliminaires. Par l'Honorable Juge L. A. Prud'homme.

Canada—Labrador. **Cabot.**
In Northern Labrador. By William B. Cabot. London: J. Murray, 1912. Size 9½ × 6, pp. xii. and 292. *Sketch-map and Illustration. Price* 12*s. net. Presented by the Publisher.*

Canada—North-West Territories—Geology. **McInnes and Wilson.**
Canada. Department of Mines. Geological Survey Branch. Report on a part of the North-West Territories drained by the Winisk and Attawapiskat rivers. By William McInnes. Report on a traverse through the southern part of the North-West Territories from Lac Seul to Cat lake in 1902. By Alfred W. G. Wilson. Ottawa, 1910. Size 10 × 6½, pp. [84]. *Map, Diagram, and Illustrations.*

Canada—Nova Scotia—Ice action. **Brodie.**
P. Nova Scotian I. Sc. Halifax **12** (1908–09): 253–257.
Some effects of ice action near Grand Lake, Cape Breton. By W. S. Brodie. *Chart.*

Canada—Nova Scotia—Tin. **Piers.**
P. Nova Scotian I. Sc. Halifax **12** (1908–09): 239–249.
On the occurrence of tin in Nova Scotia. By Harry Piers.

Canada—Ontario—Geology. *B. Seismological S. America* **1** (1911): 159–166. **Lawson.**
On some post-glacial faults near Banning, Ontario. By Andrew C. Lawson. *Sections and Illustrations.*

Canada—Place-names. *P. and T.R.S. Canada* **5** (1911): Sect. II., 179–193. **Ganong.**
An Organization of the Scientific Investigation of the Indian Place-nomenclature of the Maritime Provinces of Canada. By Dr. William F. Ganong.

Canada—Selkirks. *Appalachia* **12** (1912): 350–361. **Harnden.**
Climbs in the Southern Selkirks. By Edward W. Harnden. *Sketch-map and Illustrations.*

Canada—Selkirks—Grand Mountain. *Appalachia* **12** (1912): 362–373. **Palmer.**
The first ascent of Grand Mountain. By Howard Palmer. *Illustrations.*

Canada—Tides. *P. and T.R.S. Canada* **5** (1911): Sect. III., 123–128. **Dawson.**
Progress of the tide in deep inlets and ordinary estuaries. By Dr. W. Bell Dawson.

United States—California. **Chase.**
Yosemite trails: camp and pack-train in the Yosemite region of the Sierra Nevada. By J. Smeaton Chase. London: T. Fisher Unwin, 1912. Size 8½ × 5½, pp. xii. and 354. *Map and Illustrations. Price* 8*s.* 6*d.*

CENTRAL AND SOUTH AMERICA.

Brazil—Earthquakes. *B. Seismological Soc. America* **2** (1912): 105–117. **Branner.**
Earthquakes in Brazil. By J. C. Branner. *Sketch-map.*

Chile—Railways. ———
República de Chile. Ministerio de Industria y Obras públicas. Inspección general de ferrocarriles en estudio y construcción. Monografía de las lineas férreas fiscales recopilada para el Congreso de Ferrocarriles de Buenos Aires en 1910. Santiago, 1910. Size 10½ × 7, pp. 230. *Maps, Sections, and Diagrams.*

Costa Rica—Geology. *Geol. Mag.* **9** (1912): 258–265. **Romanes.**
Geological notes on the peninsula of Nicoya, Costa Rica. By James Romanes. *Sketch-map.*

Panama Canal. *B.S. Belge d'Etudes Col.* **19** (1912): 472–490. **Hagemans.**
Au canal de Panama. Par P. Hagemans. *Sketch-map, Sections, and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Coal. **Power.**

Coalfields and collieries of Australia. By F. Danvers Power. Melbourne, etc., C. Parker [London, Sir I. Pitman & Sons], 1912. Size 8½ × 6, pp. xiv. and 412. *Plans and Illustrations. Price 25s. net. Presented by the Publishers.*

New South Wales. **David and others.**

New South Wales, historical, physiographical, and economic. By A. W. Jose, T. Griffith Taylor, and W. G. Woolnough. Edited by T. W. Edgeworth David. Melbourne and London: Whitcombe & Tombs, [1912]. Size 7½ × 5, pp. xii. and 372. *Sketch-maps and Illustrations. Price 4s. 6d. Presented by the Publishers.*

New Zealand—Nelson—Geology. **Bell and others.**

New Zealand. Geological Survey Branch. Bulletin No. 12 (New Series). The geology of the Dun mountain subdivision, Nelson. By James Mackintosh Bell, Edward de Courcy Clarke and Patrick Marshall. Wellington, 1911. Size 11 × 8½, pp. 72. *Maps, Sections, and Illustrations.*

New Zealand—Wellington—Geomorphology. **Cotton.**

Scottish G. Mag. **28** (1912): 306–312.

Recent and sub-recent movements of uplift and of subsidence near Wellington, New Zealand. By C. A. Cotton. *Sketch-map, Illustrations, and Sections.*

Pacific—Atmospheric Electricity. *Terrestrial Magnetism* **17** (1912): 33–41. **Nippoldt.**

Die Verteilung der Leitfähigkeit der Atmosphäre über dem Grossen Ozean, nach den Beobachtungen der "Galilee." Von Dr. A. Nippoldt. *Sketch-map and Diagram.*

The data show that the electrical conductivity of the atmosphere over the Pacific decreases from north to south, the apparent cause being the proportion of land and water in the various latitudes (see *ante*, p. 221).

POLAR REGIONS.

Antarctic—"Discovery's" Voyage. **Armitage.**

Log Book of the Antarctic Exploring S.Y. *Discovery*, from the port of Lyttelton, New Zealand, *viâ* Magellan strait (Punta Arenas) to the Falkland islands; San Miguel, Azores islands; and London, England. Commencing 8th day of June, 1904, ending 10th day of September, 1904. Kept by Lieut. Albert B. Armitage, second in command. Size 12½ × 10½, pp. 60.

Arctic—Exploration. **Peary and others.**

The Crocker Land expedition. Geographical exploration in its connection with the American Museum of Natural History. By Henry Fairfield Osborn, Robert E. Peary, and others. (Reprinted from the *American Museum Journal*, vol. 12, May, 1912.) [New York, 1912.] Size 10 × 7, pp. 153–170. *Sketch-maps and Illustrations.*

Includes a memoir of the late George Borup.

Arctic—Ice. **Toll and Kolchak.**

Mém. A. Imp. Sc. St. Pétersbourg, Phys.-Math. Cl. **26** (1909): No. 1, pp. vi. and 170.

Résultats scientifiques de l'éxpedition polaire Russe en 1900–1903, sous la direction du Baron E. Toll. Section B: Géographie physique et mathématique. Livraison 1: Les glaces de la mer de Kara et de la mer de Sibérie. Par A. Koltchak. *Illustrations.*

Arctic—Travel-Methods. *B. American G.S.* **44** (1912): 340–347. **Stefansson.**

The technique of Arctic winter travel. By V. Stefansson.

Greenland. **Amdrup and others.**

Meddelelser om Grønland **27** (1902): pp. 372; **28** (1909): pp. 542; **29** (1909): pp. 464; **30** (1911): pp. 432.

Carlsbergfondets Expedition til Øst-Grønland, udført i aarene 1898–1900, under Ledelse af G. Amdrup. 4 vols. *Maps and Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology—Deserts. **Walther.**

Das Gesetz der Wüstenbildung in Gegenwart und Vorzeit. Von Prof. Johannes Walther. 2. Auflage. Leipzig: Quelle und Meyer, 1912. Size 10½ × 7, pp. xxi. and 342. *Illustrations. Price 12m. Presented by the Publishers.*

Geophysics—Earth tides. **Schweydar.**

Veröffenthichung des K. Preussischen Geodätischen Institutes, Neue Folge Nr. 54. Untersuchungen über die Gezeiten der festen Erde und die hypothetische Magmaschicht. Von Dr. Wilhelm Schweydar. Potsdam, 1912. Size 11½ × 9½, pp. 58.

Limnology. **Halbfass.**

Der gegenwärtige Stand der Seenforschung. I.: Topographie, Hydrographie, Geologie der aussereuropäischen Seen. Von Prof. Dr. W. Halbfass. Berlin, 1912. Size 9½ × 6½, pp. 66. *Section.*

Meteorology—Temperature. *G. Arbeiten (Ule)*, Heft 7 (1912): pp. 26. **Hildebrandt.**

Vergleich der Temperatur auf dem Brocken und in der gleichen Höhe der freien Atmosphäre auf Grund neuerer Ballon- und Drachenaufstiege. Von Dr. Alfred Hildebrandt.

Noticed in the September number, p. 337.

Meteorology—Temperature. *B.S. Belge Géol.* 25 (1911): Proc.-Verb. 290-310. **Stainier.**

Du rôle des variations de température dans la dynamique externe du globe. Par X. Stainier. *Diagrams.*

Oceanography. *B.R.S.G. Madrid* 54 (1912): 139-158. **Monaco.**

Progresos de la Oceanografía. Por S. A. Ser^ma^ Alberto I. Príncipe de Mónaco.

Oceanography. *M. k.k. G. Ges. Wien* 55 (1912): 178-195. **Monaco.**

Die Fortschritte der Ozeanographie. Von Albert I. Fürsten von Monaco.

Oceanography—Current-meter. *B.I. Océanogr. Monaco*, No. 235 (1912): pp. 8. **Grein.**

Ein Hilfsmittel für direkte Strommessungen in grossen Meerestiefen. Von Klaus Grein. *Diagrams.*

Oceanography—Current-meter. *B.I. Océanogr. Monaco*, No. 231 (1912): pp. 20. **Delage.**

Bathyrhéomètre à enregistrement continu des directions et des vitesses des courants de fond. Par Yves Delage. *Diagrams.*

Physical geography. **Arey and others.**

Physiography for High Schools. By Albert L. Arey, Frank L. Bryant, William W. Clendenin, and William T. Morrey. Boston: D. C. Heath & Co. [London: G. G. Harrop & Co.], 1912. Size 8½ × 5½, pp. vi. and 450. *Maps, Illustrations, and Diagrams. Price 4s. 6d. Presented by the Publishers.*

Physical geography. **Newbigin.**

An introduction to physical geography. By Dr. Marion I. Newbigin. London: J. M. Dent & Sons, 1912. Size 7½ × 5, pp. xii. and 336. *Sketch-map and Diagrams. Price 3s. 6d. Presented by the Publishers.*

Zoogeography. **Aflalo.**

A book of the wilderness and jungle. Edited by F. G. Aflalo. London: S. W. Partridge & Co. (1912). Size 8½ × 6, pp. 344. *Illustrations. Price 6s. net. Presented by the Publishers.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Text-book. **Page.**

Man and the earth: a simple reader in human geography. By J. W. Page. London: Macdonald & Evans, 1912. Size 7½ × 5, pp. viii. and 150. *Illustrations and Diagrams. Price 1s. Presented by the Publishers.*

Commercial Geography—Text-book. **Birrell.**

Business geography. By J. Hamilton Birrell. London: Ralph, Holland & Co., [1912]. Size 7½ × 5, pp. 208. *Sketch-maps and Diagrams. Price 1s. 6d. net. Presented by the Publishers.*

BIOGRAPHY.

Ricci. **Ricci and Venturi.**

Opere storiche del P. Matteo Ricci S. I., edite a cura del Comitato per le Onoranze Nazionale . . . dal P. Pietro Tacchi Venturi. Vol. 1. I Commentarj della Cina. Macerata, 1911. Size 11 × 7½, pp. lxviii. and 650. *Illustrations and Facsimile-maps. Purchased.*

See *Journal*, vol. 37, p. 100. The second volume will reproduce the "Lettere."

GENERAL.

Bibliography. **Newcombe.**

Catalogue of the periodical publications, including the serial publications of Societies and Governments, in the Library of University College, London. By L. Newcombe. Oxford: H. Hart, 1912. Size 9 × 7, pp. viii. and 270. *Presented by the Librarian, University College.*

The titles of periodicals are arranged in strict alphabetical order, with references from indexes arranged by Society and Subject; an arrangement which renders it easy to locate items. In certain cases entries suffer from the lack of descriptive notes, and one regrets to find sizes given as octavo, etc., instead of in inches or centimetres.

Education—Text-book. **Wallis.**

A first book of general geography. By B. C. Wallis. London: Macmillan & Co., 1912. Size 7 × 4½, pp. viii. and 152. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

Education—Text-book. **Wetherill.**

The new preliminary geography. By H. B. Wetherill. London: Mills & Boon, [1912]. Size 7½ × 4½, pp. xii. and 174. *Sketch-maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

Geography—Text-book. **Herbertson.**

The Oxford Geographies. Edited by A. J. Herbertson. The elementary geography. By F. D. Herbertson. Vols. 5: North and Central America and the West Indies (pp. vi. and 152); and 6: The three Southern Continents (pp. vi. and 186). Oxford: Clarendon Press, 1912. Size 7½ × 5. *Maps and Illustrations. Prices* 1*s.* 6*d.*, 1*s.* 9*d. Presented by the Publishers.*

Royal Society.

The Record of the Royal Society of London. 3rd edit. London: H. Frowde, 1912. Size 10½ × 8, pp. viii. and 484. *Illustrations. Price* 15*s. net. Presented by the Royal Society.*

Royal Society.

The signatures in the first Journal-Book and the Charter-Book of the Royal Society, being a facsimile of the signatures of the Founders, Patrons, and Fellows of the Society from the year 1660 down to the present time. London: H. Frowde, 1912. Size 18 × 13½, pp. xii., 6, 94, and 32. *Portrait. Price* £3 3*s. net. Presented by the Royal Society.*

Sport. **Wilhelm.**

From my hunting day-book. By H. I. and R. H. the Crown Prince of the German Empire and of Prussia. London: Hodder & Stoughton, 1912. Size 8 × 5½, pp. xvi. and 132. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1912.

4 miles to 1 inch:—

Sheets 13 and 15, engraved in outline. *Price* 1*s.* 6*d. each.*

1-inch scale map:—

Sheet 305. Fourth edition, engraved in outline. *Price* 1*s.*

6-inch scale maps:—

Revised. Quarter-sheets, with contours in blue.
Berkshire, 3 sheets. **Cheshire**, 1 sheet. **Hampshire**, 2 sheets. **Lancashire**, 3 sheets. **Sussex**, 4 sheets. **Yorkshire**, 4 sheets. **Yorkshire**, 1 sheet, with contours in black. *Price* 1*s. each.*

1:2500 scale maps:—

Revised, with houses stippled and with areas.
Berkshire, 30 sheets. *Price* 3*s. each.* **Denbighshire**, 50 sheets. *Price* 1*s.* 6*d. each*

Flintshire, 6 sheets. **Lancashire**, 23 sheets. **Oxford**, 15 sheets. **Surrey**, 5 sheets. **Sussex**, 35 sheets. *Price* 1*s.* 6*d. each.* **Yorkshire**, 27 sheets. *Price* 3*s. each.*

(*E. Stanford, Ltd., London Agent.*)

British Isles—England. **Railway Clearing House.**

Official Railway Map of the Yorkshire District. Scale 1 : 126,720 or 1 inch to 2 stat. miles. 2 sheets. Prepared and published at the Railway Clearing House, London, 1912. *Price* 5*s.* 6*d. each sheet.*

British Isles—Scotland. **Bartholomew.**

Bartholomew's new reduced survey map of Scotland. Scale 1 : 126,720 or 1 inch to 2 stat. miles. Sheets: 9, Berwick and Haddington; 21, Inverness and Spey. Edinburgh: John Bartholomew & Co., [1912]. *Price* 2*s. net. each sheet. Presented by the Publishers.*

Central Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: Chemnitz; Kowel. Berlin: R. Eisenschmidt, 1912. *Price* 1.50 *M. each sheet.*

Europe. **Freytag.**

G. Freytag's Automobil- und Radfahrer-Karten. Scale 1 : 300,000 or 1 inch to 6·3 stat. miles. Sheet: 3, Schwerin; 8, Hannover; 10, Frankfurt a. d. Oder; 11, Posen; 13, Kassel. Vienna: G. Freytag & Berndt, [1912]. *Price* 2 *Kr. each sheet. Presented by the Publishers.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Königreich Preussen. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets (Kupferdruck Ausgabe): 254, Argenau; 361, Nordhausen; 384, Cassel; 385, Heiligenstadt. Berlin: R. Eisenschmidt, 1911. *Price* 1.50 *M. each sheet.*

Germany. **Ministerium d. Öffentlichen Arbeiten, Berlin.**

Uebersichts-Karte der vereinigten Preussischen und Hessischen Staatseisenbahnen. Bearbeitet im Kartographischen Bureau des Ministeriums der öffentlichen Arbeiten. 14te Auflage. Scale 1 : 600,000 or 1 inch to 9·5 stat. miles. Berlin: Simon Schropp, 1912. *Presented by the Publisher.*

This is the fourteenth edition of a boldly executed diagrammatic map showing the Prussian and Hessian state railways. The different systems, or directorates, are indicated by the colours in which the lines are shown, and other useful information is given connected with railway communication. The map is an official publication.

Holland. **Beekman.**

Geschiedkundige Atlas van Nederland. Uitgegeven door de Commissie voor den geschiedkundige Atlas van Nederland en geteenkende door het lid der Commissie A. A. Beekman. The Hague: Martinus Nijhoff, [1912].

The second part of the historical atlas of the Netherlands which was noticed in the *Geographical Journal* for April last. It contains sheets 7, 10, 12, and 16 of the Republic in 1795, in continuation of those published in the first part.

Russia. **Opitz.**

Eisenbahn- und Verkehrs-Handatlas von Russland. Dritte verbesserte Auflage. Bearbeitet und herausgegeben von C. Opitz. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. Leipzig: Verlag für internationales Reise- und Verkehrswesen, 1911.

A map of European Russia, measuring 56 inches by 48 inches, showing railways, steamer-lines, canals, and other information connected with means of communication, taken from Russian sources. A useful index of the railway stations, with a directory of the principal German firms having commercial relations with Russia accompanies the map as a separate pamphlet. The names of the principal places on the map and all those in the index are given in German and Russian.

Sweden. **Generalstab, Stockholm.**

Generalstabens Karta öfver Sverige. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheet: 62, Bjorna S.O.; 89, Grangärde. Stockholm: Generalstabens Litografiska Anstalt, 1912. *Presented by the Swedish Government.*

ASIA.

Annam. **Service Géographique de l'Indo-Chine.**

Carte des Deltas de l'Annam. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Sheet 1, Dông-So'n. Hanoi: Service Géographique de l'Indo-Chine, 1908. *Price* 1 *piastre each sheet.*

Asia Minor. **Kiepert.**

Karte von Kleinasien bearbeitet von Dr. Richard Kiepert. Zweite berichtigte Ausgabe. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Sheets : AII., Constantinople ; CII. Afiun Karahisar. Berlin : Dietrich Reimer (Ernst Vohsen), 1912.

The first of these sheets includes Constantinople, the Bosporus, Gulf of Ismia, and extends to the east as far as 30° 55′ E. long. : while the second includes the area from 37° 85′ to 38° 55′ N. lat., and from 28° 15′ to 31° 5′ E. long., and thus embraces the upper Meander valley, Laodicea, Colossæ and other sites of historical interest. They are both second editions, revised, with additions. As is the case with the other sheets of this second edition, the lowlying land is tinted green.

China. **Richthofen.**

Atlas von China. Orographische und geologische Karten von Ferdinand Freiherr von Richthofen zu des Verfassers Werk China ergebnisse eigener Reisen und darauf gegründeter Studien. Zweite Abtheilung : Das südliche China (zum dritten Textband gehörig). Bearbeitet von Dr. M. Groll. Berlin : Dietrich Reimer (Ernst Vohsen), 1912. *Presented by the Publisher.*

This will be specially noticed in the *Geographical Journal.*

Russia. **Military Topographique Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. [In Russian.] Scale 1 : 1,168,031 or 1 inch to 26·5 stat. miles. Sheet xvi. Korea. St. Petersburg : Military Topographical Department, 1911.

AFRICA.

Africa. **Director of Surveys, Southern Nigeria.**

Africa. Scale 1 : 125,000 or 1 inch to 1·9 stat. miles. Sheet $\frac{\text{North B31}}{\text{J–1 and 111}}$ Lagos, Southern Nigeria. Published by the authority of Sir Frederick Lugard, G.C.M.G., C.B., D.S.O., Governor, under the direction of Major F. S. Guggisberg, C.M.G., R.E., Director of Surveys, Southern Nigeria, and Captain R. N. Rowe, R.A., Deputy Director, Topographical Branch. Revised to June 1, 1911. Edinburgh and London : W. & A. K. Johnston, Ltd., [1912]. *Price* 1*s.* 6*d. each sheet. Presented by the Publishers.*

From an inspection of this sheet it will be clear that a great improvement has taken place recently in the cartographical productions of this part of West Africa. Instead of black and white outline maps without any indication of relief, the present issue is printed in colours with form-lines or approximate contours in brown at 50 and 100 feet intervals, with their relative degree of accuracy shown by the character of line in which they are drawn. The map gives much detailed information, and on the left-hand border is a most complete explanation of all the symbols employed.

Africa. **Geographical Section, Geographical Staff.**

Map of Africa. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Compiled at the Geographical Section, General Staff, War Office, 1912. Sheets : Northern Nigeria, North–B–31 C, Abinsi ; North–C–31 E, Sabongari ; North–C–31 F, Zuru. East Africa Protectorate, South–A–37 H, Machako's ; South–A–37 N, Makindu. London agents : Edward Stanford, Ltd. ; Sifton Praed ; T. Fisher Unwin. *Price* 1*s.* 6*d. net. each sheet.*

Northern Nigeria. **Calvert.**

A. F. Calvert's plan of the Bauchi, Zaria, and Kano Tin Fields, Northern Nigeria, showing the Railway and Roads to the Tin Fields. Scale 1 : 3,358,080 or 1 inch 5·3 stat. miles. London : Edward Stanford, Ltd., 1912.

A roughly drawn black and white map showing the location of the various tin-mines with the boundaries of the exclusive prospecting areas, and proprietors' names. Telegraph lines, roads and railways, proposed and constructed, are also shown.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 17, Cypress, Saskatchewan, revised to February 28, 1912 ; 20, Souris, Saskatchewan, revised to February 9, 1912 ; 24, Lake of the Woods, Manitoba and Ontario, revised to March 7, 1912 ; 67, Maple creek, Saskatchewan, revised to May 20, 1912 ; 317, Fort Pitt, Saskatchewan, revised to July 8, 1912. Ottawa : Surveyor-General's Office, 1912. *Presented by the Department of the Interior, Topographical Surveys Branch, Ottawa.*

North America. **Bartholomew.**

Orographical reduced survey map of the United States and part of Canada. By J. G. Bartholomew, LL.D., F.R.G.S. Scale 1 : 5,000,000 or 1 inch to 81·9 stat. miles. Edinburgh : John Bartholomew & Co., [1912]. *Price 5s. net. Presented by the Publisher.*

A general map showing heights of land on the colour-layer system in tints of green and brown, at the following intervals in feet: sea-level to 100, 100–500, 500–1000, 1000–2000, 2000–3000, 3000–4000, 4000–5000, 5000–10,000, and then above 10,000. The result is decidedly effective, and the map contains a large number of place-names, railway lines, and other information which will render it useful for reference.

AUSTRALIA.

Western Australia. **Hunt.**

Average rainfall map and isohyets of Western Australia, Division No. 1, Section 4. Compiled under the direction of H. A. Hunt, Commonwealth Meteorologist. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. Melbourne: Minister of Home Affairs, 1911. *Presented by the High Commissioner for Australia.*

GENERAL.

World. **Debes.**

E. Debes' Neuer Handatlas über alle Teile der Erde in 65 Haupt- und über 130 Nebenkarten mit alphabetischem Namenverzeichnis. 4. Stark vermehrte und verbesserte Auflage. Lieferungen 21 u. 22. Leipzig: H. Wagner & E. Debes, 1912. *Price 80 Pf. each part.*

The following maps are contained in these parts:—Lieferung 21: No. 13, Mittel-Europa, Verkehrskarte; 56, Östliche Vereinigte Staaten. Lieferung 22: No. 43, Südost-Asien; 54, Nord-Amerika.

World. **Kiepert.**

Henrici Kiepert: Formæ Orbis Antiqui. 36 Karten mit Kritischem Text und Quellenangabe. Bearbeitet und herausgegeben von Richard Kiepert. Sheet xxxiv. Imperium Romanum ab imperatore Diocletiano a p. Chr. n. 297 in diœceses et provincias distributum. Berlin: Dietrich Reimer (Ernst Vohsen), 1912. *Price 3m. each sheet, with text.*

This part contains an important general map of the whole of the Roman Empire at the time of Diocletian, A.D. 297. It is accompanied by a sheet of text giving the sources of information, and a general discussion on the material used in the construction of the map.

World. **Ordnance Survey, Southampton.**

International Map of the World. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheets: North O 29, The Hebrides; North O 30, Scotland, The Highlands. Southampton: Ordnance Survey Office, 1912. *Price 1s. 6d. net each sheet.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from September 8 to 28, 1912. *Presented by the Hydrographer, Admiralty.*

New Editions—No. 2040, England, south coast: The Solent, including the Needles channel, 3*s*. 2550, Scotland, east coast: The port and vicinity of Wick, 2*s*. 2017, Ireland, south coast: Dungarvan harbour, 2*s*. 2842*b*, Baltic sea, eastern sheet (Plans: Färö sound, Ertholms or Christiansö, Neufahrwasser, Memel, river Dvina from the roadstead to the town of Riga, Wormsö channel, Tiefen hafen, Hepsal harbour), 5*s*. 1770, Baltic sea: Port of Libau, 2*s*. 2227, Gulf of Finland: Revel roadstead; New plan of Revel harbours on this sheet, 2*s*. 2301, Gulf of Bothnia: Fiäderägg to Tome point and Gamle Karlebyu (Gamba Karleby) to Tauvo, 3*s*. 1104, Bay of Biscay, 3*s*. 142, Strait of Gibraltar, 3*s*. 469, Mediterranean, Spain: Port of Alicante, 2*s*. 344, Mediterranean, Spain: Port of Tarragona, 3*s*. 1140, Plans in the Gulf of St. Lawrence: Wapitagun harbour, Coacoacho bay, Kegashka bay, Natashkwan harbour, 2*s*. 2677, West Indies: Culebra or Passage island, 3*s*. 703, Plans on the north coast of South America: La Guaira harbour; Plan added: Carenero harbour, 2*s*. 1573, Central America: Honduras gulf with the Zapotillos cays, 3*s*. 6*d*. 1803, South America, north-east coast: Cabo do Norte to Maranham, 2*s*. 2186, South America, north-east coast: River Pára; Plan of approaches to city of Pára on this sheet erased, 2*s*. 1082, Harbours on the coast of California: Wilmington and San Pedro harbours, 1*s*. 6*d*. 1713, Anchorages on the west coast of Africa: Cape Three

Points, Dix cove, Elmina bay, Cape Coast Castle; Plans of Axim bay, Takoradi bay, and Chama bay on this sheet erased, 2*s*. 1116, Madagascar: Diego Suarez bay, 3*s*. 934, Eastern archipelago: Surabaya, Bali, and Sapudi straits, with anchorages in Bali and Kangeang islands: Surabaya strait, Sapudi strait, Sumenep bay, Ketapang bay, Temukus (Tebunkus) road, Bunkulan road, Buleleng road, Sangsit road, Kubu road, Ambat (Chulik) road, Juana and Rembang roads, Labuan Amuk and Ujung road, Benoa channel, Pantai Timur and Sanur road, Saubi road, West coast of Nusa Besar, Tianjar road, 3*s*. 2185, New Zealand, South island: Nelson anchorages, 2*s*. 772, Islands and reefs in the Caroline islands: Uluthi or Mackenzie islands, Olol islands, Pigelot or Coquille island, Olimarao island, Elato and Lamotrek islands, West Faiu island, Wolea or Ulie islands, Lükté island, Hall islands, Namoluk islands, Mortlock islands, Pingelap or Macaskill islands, Chamisso harbour, Faraulep island, Ifalik or Wilson islands, Ngatik islands; New plans of Feys or Tromelin island, Mokil or Kalap islands, and Iuripik or Kama islands on this sheet, 3*s*.

Atlantic. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, September and October, 1912; ditto, South Atlantic Ocean, September, October, November, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic, August and September, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, September and October, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, September and October, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, October and November, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, September and October, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

North America—Great Lakes. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, September and October, 1912. Washington, Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Pacific. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, September and October, 1912; ditto, South Pacific Ocean, September, October, and November, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, October and November, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Canary Islands. **Bannerman.**

Seventy-three photographs of Gran Canaria, Canary Islands, taken by D. A. Bannerman, Esq., B.A.

These photographs are from films kindly lent to the Society by Mr. Bannerman. They are good clear prints, measuring 3¼ by 6 inches, and typical of the island.

(1) Atalaya; (2) Women dwellers in Atalaya; (3) Chestnut wood, San Mateo; (4) San Mateo village; (5) Cumbres from below Santa Brigida village; (6) Camp in Juncal barranco; (7) Camp below Cueva de las Ninas; (8) Camp, showing "Pinar"; (9 and 10) Camp below Roque Nublo; (11) Showing curious rock formation in Cumbres; (12) Desert plateau, with Spanish muleteers; (13) View towards Isleta; (14) Cueva

pelas Ninas, caves turned into dwelling-houses; (15) Shepherds and typical Canary sheep-dog; (16) Typical sheep-dog; (17) View along Juncal towards Tenerife; (18) Barranco and village of Juncal; (19) Looking down Barranco towards sea; (20–24) Views from summit of Cumbres, looking south; (25) In the mountains; (26) My five Spanish muleteers; (27) View of Cumbres; (28) View of Pinar Pajonal; (29) Santa Brigida village; (30) The fruit boat; (31) Loading boats with fruit at Mogan; (32 and 33) Early morning in the mountains; (34) Camp on Cueva de la Ninas; (35) Pine forest near Cueva de las Ninas; (36) Barranco de Mogan; (37) Panorama showing camp above Cueva de las Ninas; (38) Caravan on the way up Barranco de Mogan; (39) Puerto Mogan from the sea; (40) View in typical Pinar; (41) The Charco Maspalomas, showing lighthouse; (42) The lighthouse at Maspalomas; (43 and 44) The Charco of Maspalomas; (45) The mouth of the Charco; (46) The Charco sea-water joining the fresh water; (47) Almost stagnant pools in the Charco; (48) Desert near Maspalomas; (49) Maspalomas bay; (50) Barranco leading from behind Maspalomas village towards Fataga and Tirajana; (51) Fresh-water pools far up the Maspalomas Barranco; (52) Coast-line between Maspalomas and Arguineguin; (53) Camp at the Charco Maspalomas; (54) Ox-cart at camp near Maspalomas; (55) Ox-cart removing camp to the Charco; (56) Two Spanish muleteers; (57) Crossing the desert between Carrisal and Maspalomas; (58) Lava stream from Caldera; (59) Single plant of *Euphorbia canariensis*; (60) Clumps of *Euphorbia canariensis*; (61 and 62) Panorama of Charco Maspalomas; (63) Tent and rushes, Charco Maspalomas; (64) View of the Charco from top of sandhill; (65) Leaving Juan Grande; (66) Cactus plants; (67) Oxen ploughing; (68) Isleta; (69 and 70) Isleta and Confital bay; (71) Puerto de la Luz and Isleta; (72 and 73) Cliffs looking towards Guanarteme from Confital bay.

Lapland. **Mesch.**

Fifty photographs of Swedish Lapland, taken by Mr. Borg Mesch. *Presented by J. R. G. Tilbury, Esq.*

A characteristic set of photographs, giving an excellent idea of the mountain scenery, waterfalls, inhabitants and their dress, etc.

(1) Tome Trask from Pickseniemi; (2) The midnight sun at Tome Trask; (3) Nuoljajokk; (4) View from Nuoljajokk; (5) View from Nuolja; (6) Kebnetjakko from the upper Tarfalladalen; (7) Kebnekaise from the upper Tarfalladalen; (8) Kaskassatjakko from the upper Tarfalladalen; (9) Kaskassatjakko from Kebnetjakko; (10–13) Views from Kebnekaise; (14) Summit of Kebnekaise; (15) Abiskojokk cañon; (16) View from Abiskojaure; (17) Marble quarry at Abiokojokk; (18 and 19) Laimolahti; (20) Rakkaskortja; (21) Laplanders at Rautasjarvi; (22) Rautasjarvi; (23) Porjusfallen; (24) Mellersta fallet; (25) Ruotokortja, Porjus; (26) Vudskovuma; (27) Reitajoklame; (28) Stora Sjofallet; (29) Harspranget; (30) Rautasluspa; (31) Kirunavaara at night; (32) Pirtivuopio; (33) Vistesdalen; (34) Cañon of Sordalen; (35) Ravine of Luopahta; (36–45) Laplanders; (46) Lapland instruments and weapons; (47) A risky situation in the rapids; (48–50) Reindeer.

Somaliland and Abyssinia. **Hayne.**

Thirty-two photographs of Somaliland and Abyssinia, taken by R. Hayne, Esq., J.P. *Presented by R. Hayne, Esq., J.P.*

An interesting set of panoramas, measuring 3¾ by 12 inches, the titles of which are as follows:—

(1) Camp in Somaliland; (2) Abyssinian Somaliland; (3) Gallas and Abyssinians; (4) Gallas; (5) Head and skin of the mountain Nyala; (6) Caravan on the plains east of Jig Jiga; (7) Stockade of Abdulla Dah, Jig Jiga; (8) Camp near the Ogaden Somalis; (9) Harrar; (10) Street in Harrar; (11) One of the four gates of Harrar; (12) Houses in Harrar; (13) Sudden spate in the usually dry river-bed at Dire Daua; (14) Plain of the Isa Somalis; (15) The Hawash river; (16) Looking on to the Hawash river gorge; (17–19) The Arussi country; (20) Arussi hills; (21 and 22) Forest in Arussi country; (23 and 24) Camp in Arussi country; (25) Galla village in Arussi country; (26) Gallas collecting hay in a tree, Arussi country; (27) Somalis in the Fafar valley; (28) Camp on Malka Gadoalba river; (29) Camels crossing Malka Gadoalba river; (30) Boiling water springs, Malka Gadoalba river; (31) Camp on Tachenwoha river; (32) Country south-west of Tachenwoha river.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

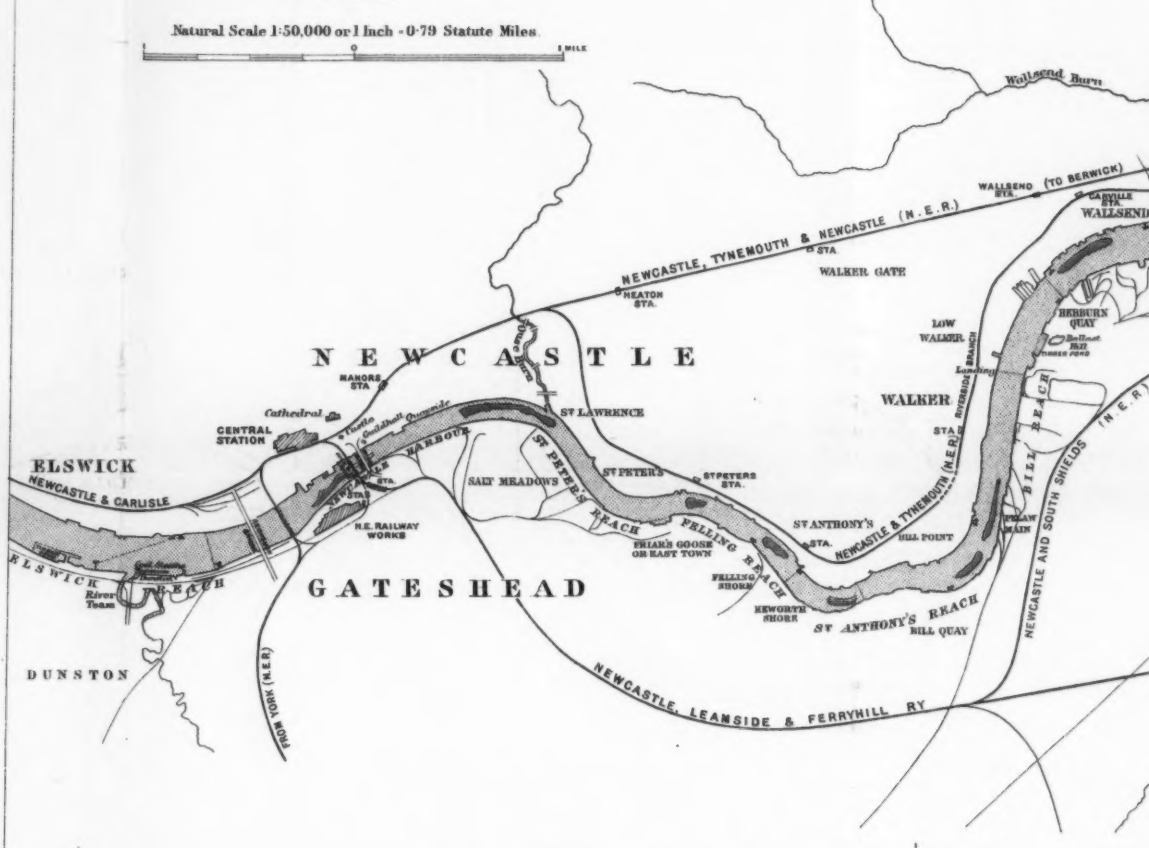
RIVER TYNE

FROM

ADMIRALTY CHARTS

1909

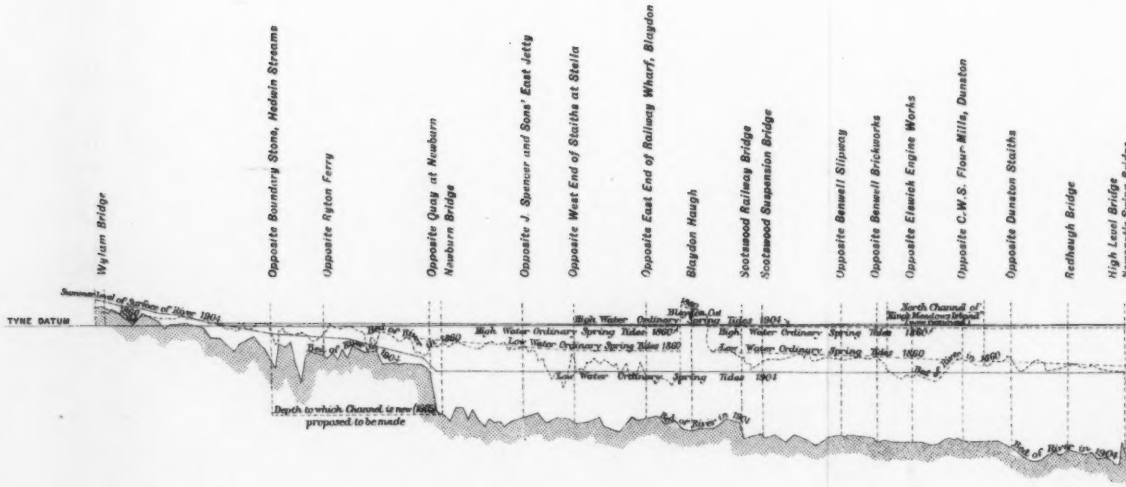
Natural Scale 1:50,000 or 1 Inch = 0·79 Statute Miles.



TYNE IMPROV

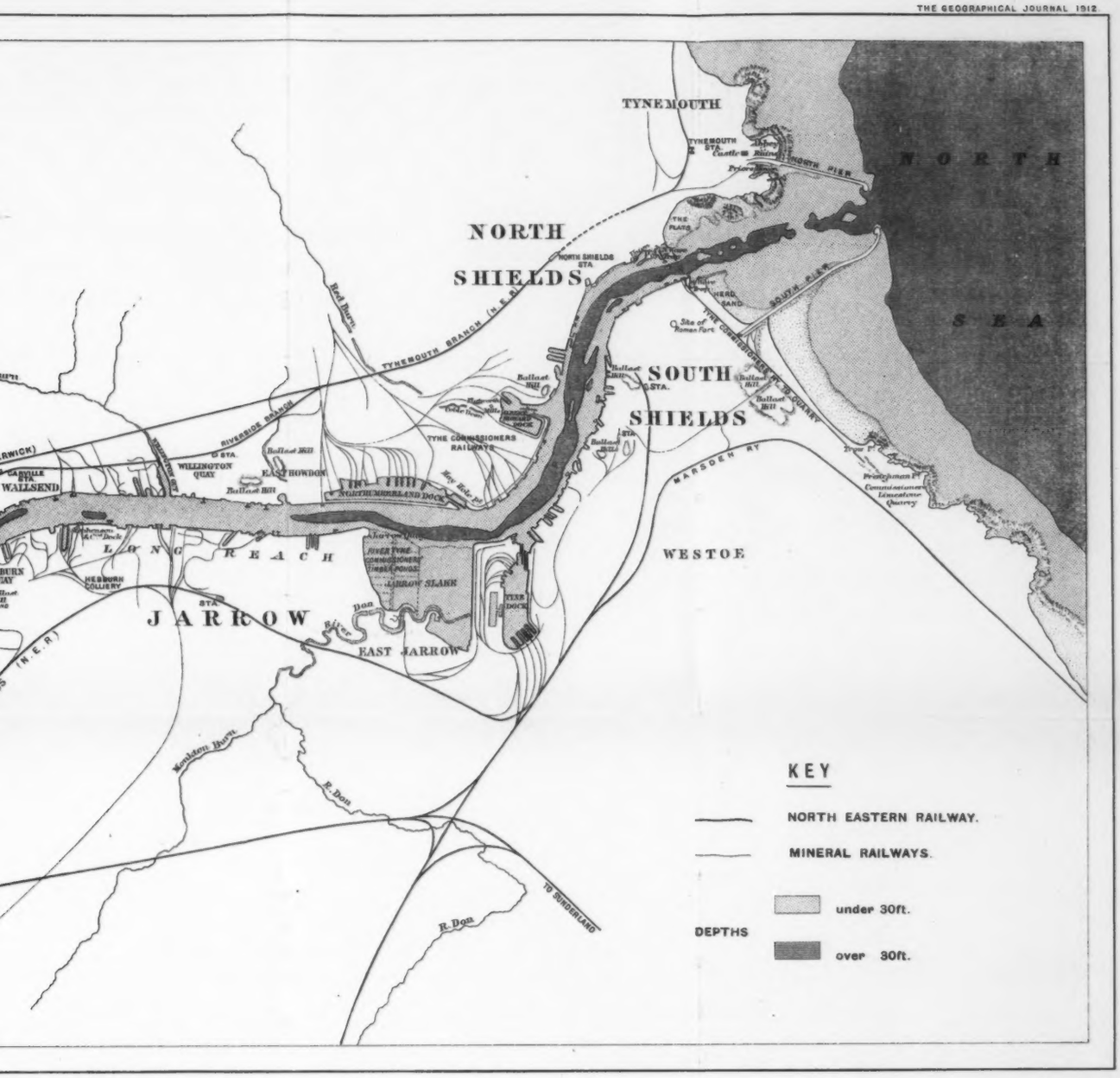
LONGITUDINAL SECTION ON THE CENT

Showing the Depths of the Channel an
1860 and 1904, from Surveys made u


Wylam Bridge
Opposite Boundary Stone, Hedwin Streams
Opposite Ryton Ferry
Opposite Quay at Newburn
Newburn Bridge
Opposite J. Spencer and Sons' East Jetty
Opposite West End of Staiths at Stella
Opposite East End of Railway Wharf, Blaydon
Blaydon Haugh
Scotswood Railway Bridge
Scotswood Suspension Bridge
Opposite Benwell Slipway
Opposite Benwell Brickworks
Opposite Elswick Engine Works
Opposite C.W.S. Flour Mills, Dunston
Opposite Dunston Staiths
Redheugh Bridge
High Level Bridge
TYNE DATUM
Depth to which Channel is now (1904) proposed to be made

NOTE — The Tyne Datum is level with the Notch cut in the Masonry at the South West Corner of the Low Lighthouse, North Shields, and marked D thereon, being High Water Mark at that place on the 31st May, 1813.

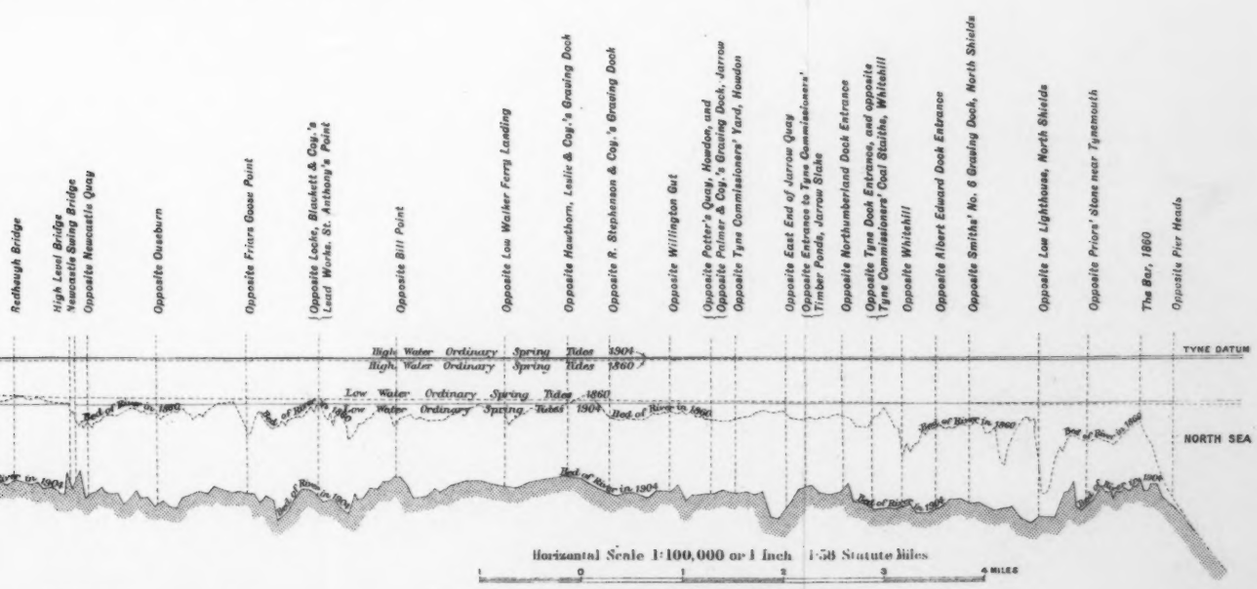
Published by the



PROVEMENT COMMISSION.

CENTRE LINE OF RIVER FROM THE SEA TO WYLAM

Channel and the lines of High and Low Water Ordinary Spring Tides, in
eys made under the direction of Mr. J. F. Ure and Mr. James Walker.


Redheugh Bridge
High Level Bridge
Newcastle Swing Bridge
Opposite Newcastle Quay
Opposite Ouseburn
Opposite Friars Goose Point
Opposite Locke, Blackett & Coy.'s Lead Works, St. Anthony's Point
Opposite Bill Point
Opposite Low Walker Ferry Landing
Opposite Hawthorn, Leslie & Coy.'s Grasing Dock
Opposite R. Stephenson & Coy.'s Grasing Dock
Opposite Willington Gut
Opposite Potter's Quay, Howdon, and Opposite Palmer & Coy.'s Grasing Dock, Jarrow
Opposite Tyne Commissioners' Yard, Howdon
Opposite East End of Jarrow Quay
Opposite Entrance to Tyne Commissioners' Timber Ponds, Jarrow Slake
Opposite Northumberland Dock Entrance
Opposite Tyne Dock Entrance, and opposite Tyne Commissioners' Coal Staiths, Whitehill
Opposite Whitehill
Opposite Albert Edward Dock Entrance
Opposite Smiths' No. 6 Grasing Dock, North Shields
Opposite Low Lighthouse, North Shields
Opposite Prior's Stone near Tynemouth
The Bar, 1860
Opposite Pier Heads
High Water Ordinary Spring Tides 1904
High Water Ordinary Spring Tides 1860
Low Water Ordinary Spring Tides 1860
Low Water Ordinary Spring Tides 1904
TYNE DATUM
NORTH SEA
Bed of River in 1860
Bed of River in 1904

Horizontal Scale 1:100,000 or 1 Inch 1·58 Statute Miles

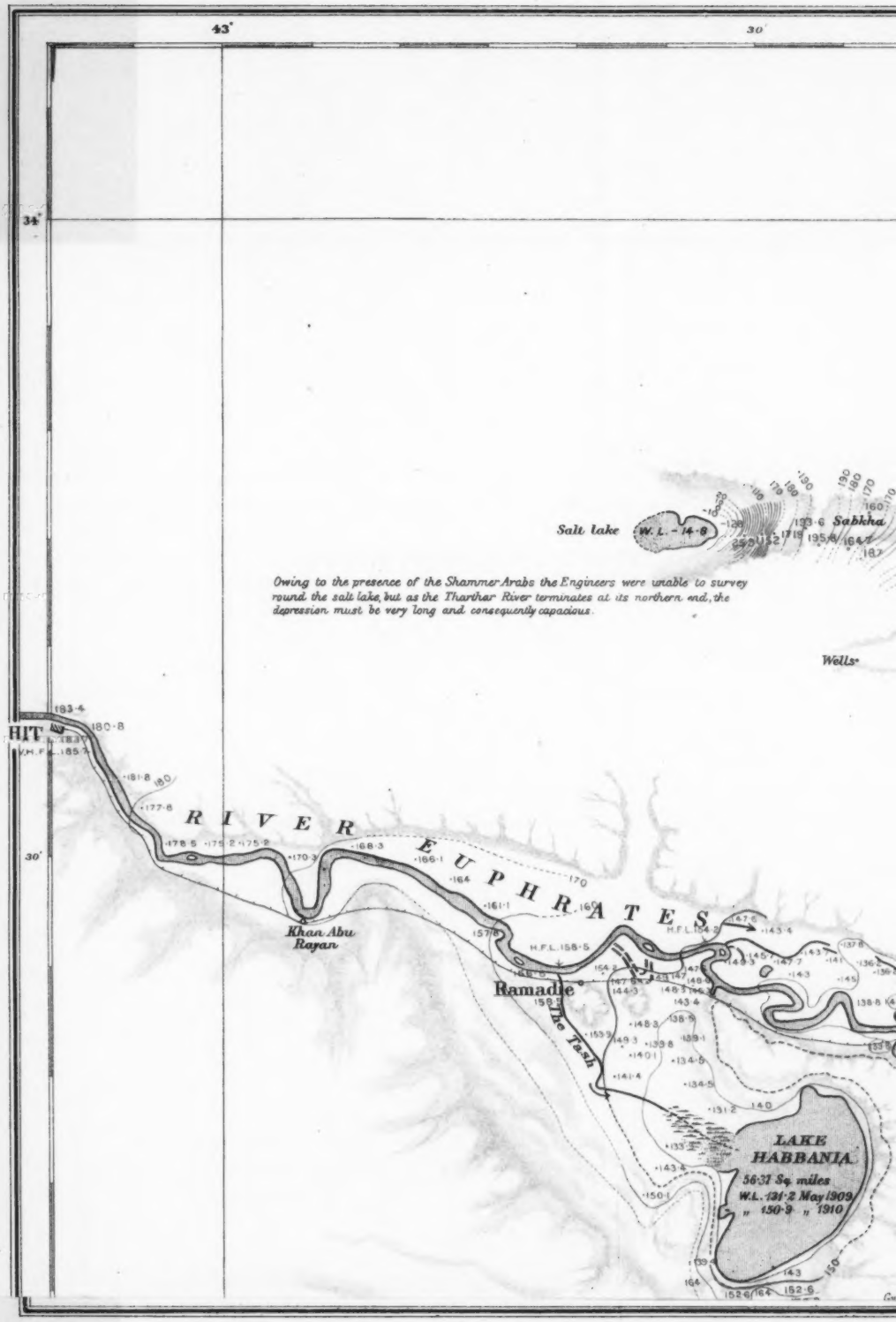
0 1 2 3 4 MILES

Vertical Scale exaggerated 16 times

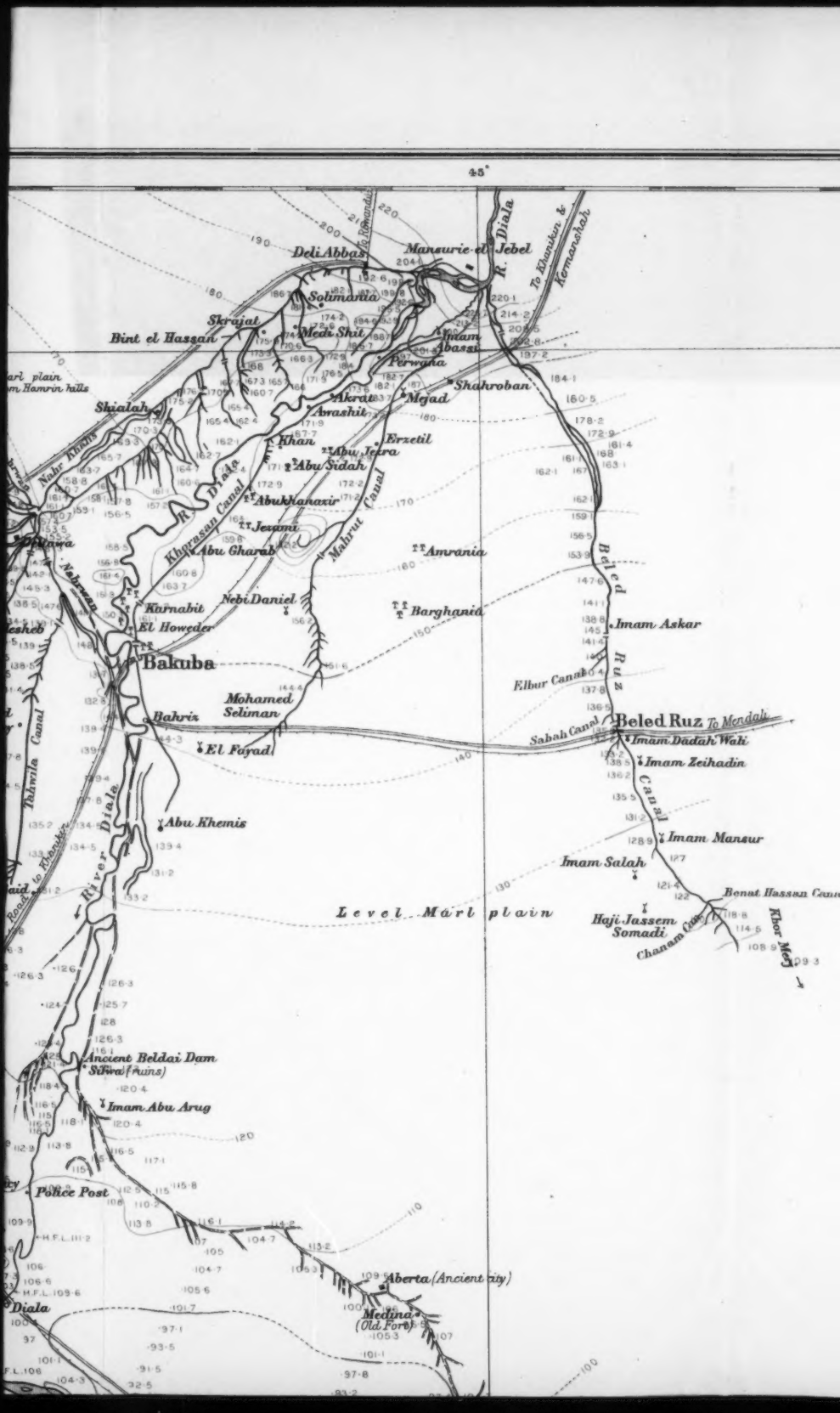
50 0 50 100 FEET

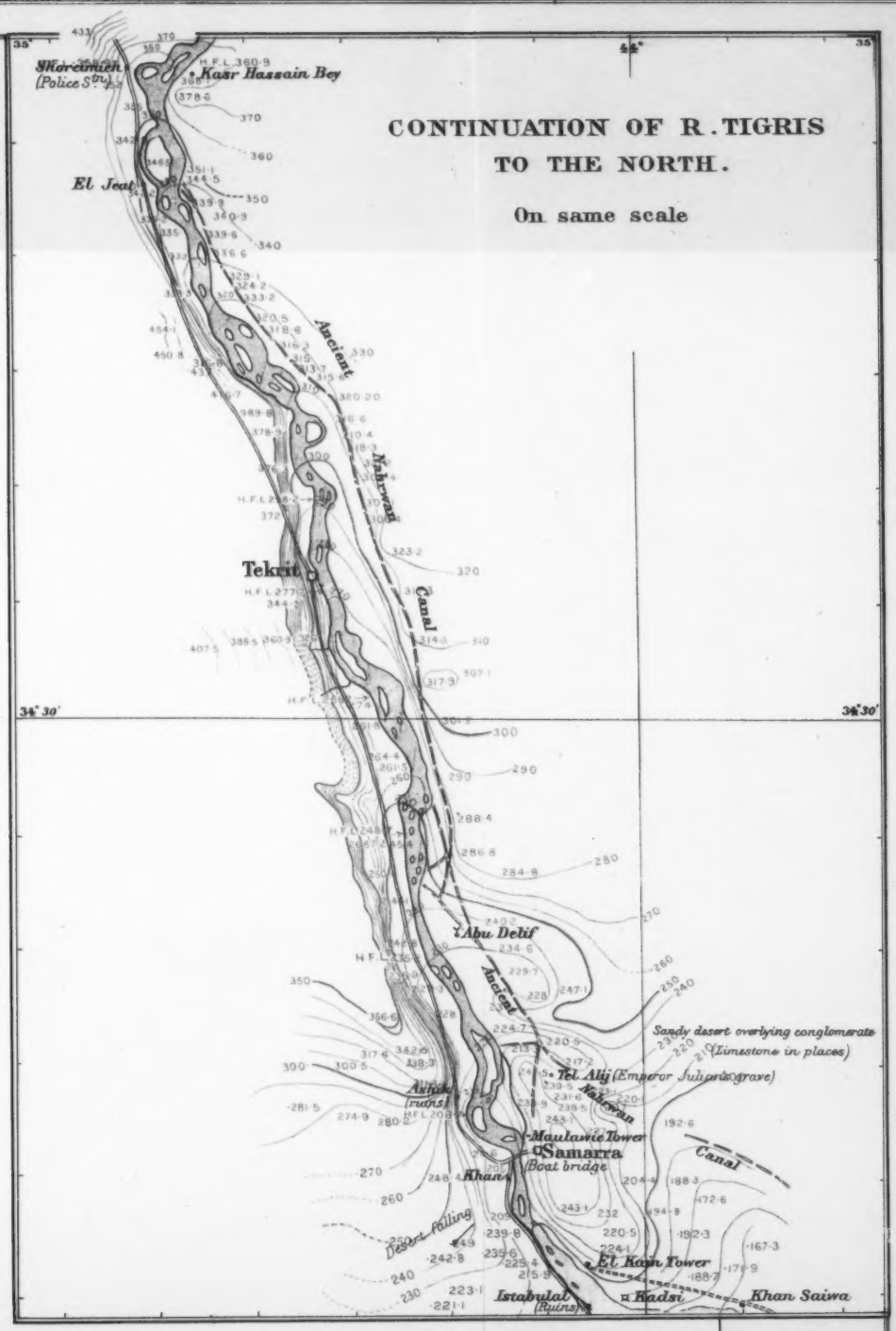
by the Royal Geographical Society

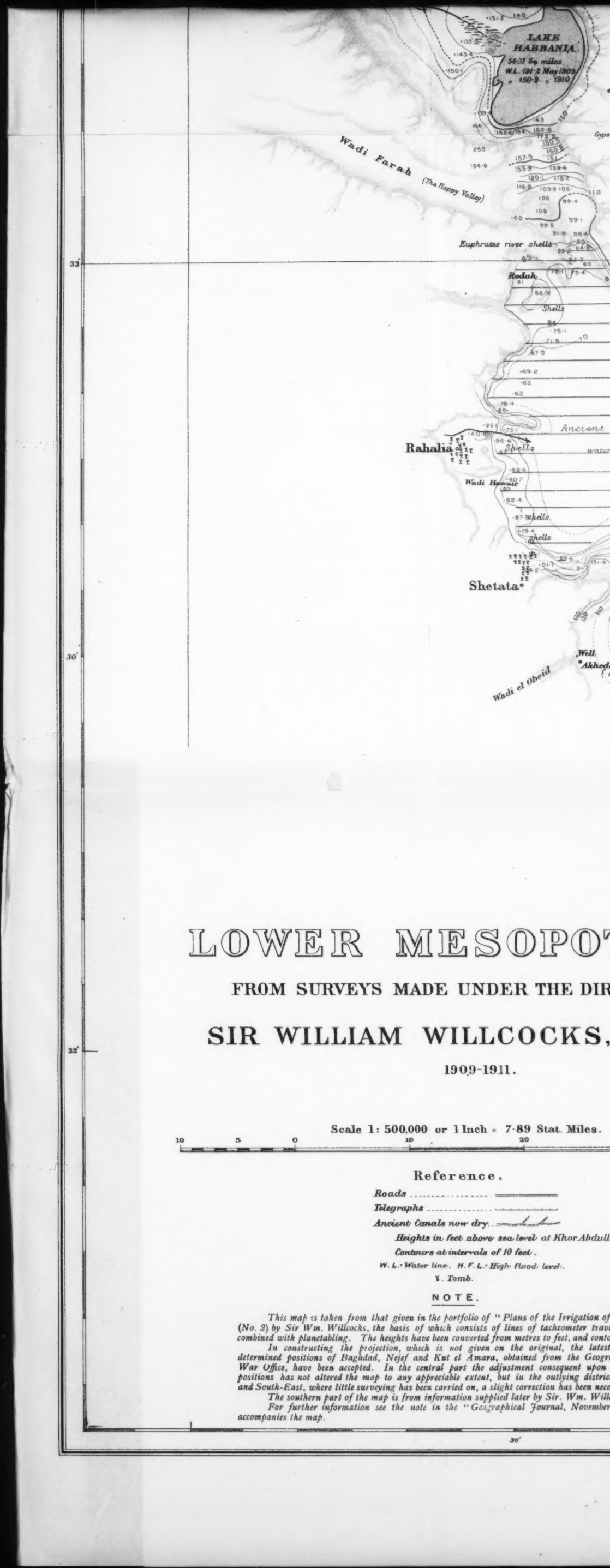
R. TYNE
Sargent.


43'
30
34'
30'
Salt lake
W. L. - 14·8
Sakhka
Owing to the presence of the Shammer Arabs the Engineers were unable to survey round the salt lake, but as the Tharthar River terminates at its northern end, the depression must be very long and consequently capacious.
Wells
HIT
R I V E R E U P H R A T E S
Khan Abu Rayan
Ramadie
The Tash
LAKE HABBANIA
56·31 Sq. miles
W.L. 131·2 May 1909
" 150·9 " 1910

Published by the Royal Geographical So


45°
Deli Abbas
Mansurie el Jebel
R. Diala
To Khanikin & Kermanshah
To Kifri
Solimania
Skrajat
Bint el Hassan
Medi Shit
Imam Abassi
Perwana
Shahroban
Mejad
Akrat
Arashit
Shialah
Nahr Imam
Khan
Erzetil
Abu Jekra
Abu Sidah
Abuk Hanaxir
Jezani
Khorasan Canal
R. Diala
Mahrut Canal
Abu Gharab
Amrania
Nahrwan
Karnabit
El Howeder
Nebi Daniel
Barghania
Bakuba
Imam Askar
Beled Ruz
Elbur Canal
Mohamed Seliman
Bahriz
El Fayad
Sabah Canal
Beled Ruz
To Mendali
Imam Dadah Wali
Imam Zeihadin
Tahwila Canal
Abu Khemis
River Diala
Imam Mansur
Imam Salah
Bonat Hassan Canal
Level Marl plain
Haji Jassem Somadi
Chanam Canal
Khor Mej
Ancient Beldai Dam
Sikra (Ruins)
Imam Abu Arug
Police Post
Aberta (Ancient city)
Medina (Old Fort)
Diala


CONTINUATION OF R. TIGRIS
TO THE NORTH.
On same scale
35°
34° 30'
Kasr Hassain Bey
El Jeat
Ancient
Nahrwan
Canal
Tekrit
Abu Debif
Sandy desert overlying conglomerate
(Limestone in places)
Tel Alij (Emperor Julian's grave)
Maulanie Tower
Samarra
(Boat bridge)
Khan
Desert rolling
El Kain Tower
Istabulat
(Ruins)
Kadsi
Khan Saiwa



LOWER MESOPO

FROM SURVEYS MADE UNDER THE DIR

SIR WILLIAM WILLCOCKS,

1909-1911.

Scale 1: 500,000 or 1 Inch = 7·89 Stat. Miles.

10 5 0 10 20

Reference.

Roads .....

Telegraphs .....

Ancient Canals now dry .....

Heights in feet above sea level at Khor Abdull

Contours at intervals of 10 feet.

W. L. = Water line. H. F. L. = High flood level.

T. = Tomb.

NOTE.

This map is taken from that given in the portfolio of "Plans of the Irrigation of (No. 2) by Sir Wm. Willcocks, the basis of which consists of lines of tacheometer trav combined with planetabling. The heights have been converted from metres to feet, and conto

In constructing the projection, which is not given on the original, the latest determined positions of Baghdad, Nejef and Kut el Amara, obtained from the Geogr War Office, have been accepted. In the central part the adjustment consequent upon positions has not altered the map to any appreciable extent, but in the outlying distric and South-East, where little surveying has been carried on, a slight correction has been nece

The southern part of the map is from information supplied later by Sir. Wm. Will

For further information see the note in the "Geographical Journal, November accompanies the map.

30'

OTAMIA

DIRECTION OF

KS, K.C.M.G.

Miles.

30 40 Miles.

r Abdulla

igation of Mesopotamia"
eter traverses and levels,
and contour lines added.
the latest astronomically
he Geographical Section,
nt upon accepting these
g districts to the South
been necessary.
Wm. Willcocks
November, 1912," which

Shingle and sand overlying Gypsum
Gypsum and Salted Marl
Salted Gypsum and Marl
D e s e r t
Desert
Overflow of the Euphrates in high floods (approximate)
ancient Reservoir
water level 85ft.
Euphrates river shells
Gypsum and salted Marl
Well
Akheder or el Khaidar
(ruined castle)
Nukhta
Kabr Mon'
Canal
Tel Thubba
Muslot
Abu Ghureib
Sania
Radwania
Tel Dilla
Tel Ager
Khor
Tel Raml
Tel Aswad
Tel Dehabah
Keshuk
Imam Hamza
Khan Zaad (ruins)
Tel Dem
Nahr Malcha
Tel Hubba
Mahmudie Canal
Abu Fayad
Latifia Canal
Imam Elbr (ruins)
Iskanderie Canal
Khan Iskenderie
Khan Hazwa
Desert
Babylon
Beat Bridge
Museyib
Museyib Canal
Khor
Khan Nasrie
Imam Khur
Hindie Barrage
H.F.L. 105. L.W.L. 91.2
Imam Aun
Hussainie Canal
Imam Ibnel Hassan
Imam Noh
Imam Hur
Lake Abu Dibis
W.L. 61.7 ft.
KERBELA
Suleimanie
Kala el Nakib
Meravia
Khan Mahawel
Aulad Sliman
Mahawel Sebaghiat
Hindie or Tewarij
Boat Bridge
Babil
BABYLON
Imam Sulaiman
Imam Said
HILLA
Tel Khidr
Khor
W.L. 81 ft.
Dutas Ck
el Dulas
Imam Bekr
es Saad
Imam Hasan el Hosszein
Bara Nimrud
Delba
Imam Mandi
Tower Hussein Kufaga
Tower Samawi
Zaptieh station
Kefil or Kefl
Imam Rashid
Imam Ibn Hassan
Khor el Oralji
Marshy liable to floods
Shamie
Kufa
Kufa Channel
BAHR ABU-NEJM
Khor Abu Nejm
Nejef or Meshed Ali
Shamie or Um el Ha
BAHR SHINAFIE
Shinafie
R. EUPHRATES
Nahr Abu Rova
THE HINDIE BRANCH
Carara
Iron Bridge
Diala
Khan (ruins)
Tel Omar
Khan Mahmudie
Tel Dahab
Khan Zaad (ruins)
Canal
Khor
Nahr Malcha
Tel Hubba
Mahmudie Canal
Abu Fayad
Latifia Canal
Imam Elbr (ruins)
Iskanderie Canal
Khan Iskenderie
Khan Hazwa
Desert
Babylon
Beat Bridge
Museyib
Museyib Canal
Khor
Khan Nasrie
Imam Khur
Hindie Barrage
H.F.L. 105. L.W.L. 91.2
Imam Aun
Hussainie Canal
Imam Ibnel Hassan
Imam Noh
Imam Hur
Lake Abu Dibis
W.L. 61.7 ft.
KERBELA
Suleimanie
Kala el Nakib
Meravia
Khan Mahawel
Aulad Sliman
Mahawel Sebaghiat
Hindie or Tewarij
Boat Bridge
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Imam Sulaiman
Imam Said
HILLA
Tel Khidr
Khor
W.L. 81 ft.
Dutas Ck
el Dulas
Imam Bekr
es Saad
Imam Hasan el Hosszein
Bara Nimrud
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Imam Mandi
Tower Hussein Kufaga
Tower Samawi
Zaptieh station
Kefil or Kefl
Imam Rashid
Imam Ibn Hassan
Khor el Oralji
Marshy liable to floods
Shamie
Kufa
Kufa Channel
BAHR ABU-NEJM
Khor Abu Nejm
Nejef or Meshed Ali
Shamie or Um el Ha
BAHR SHINAFIE
Shinafie
R. EUPHRATES
Nahr Abu Rova
THE HINDIE BRANCH

44° 30'

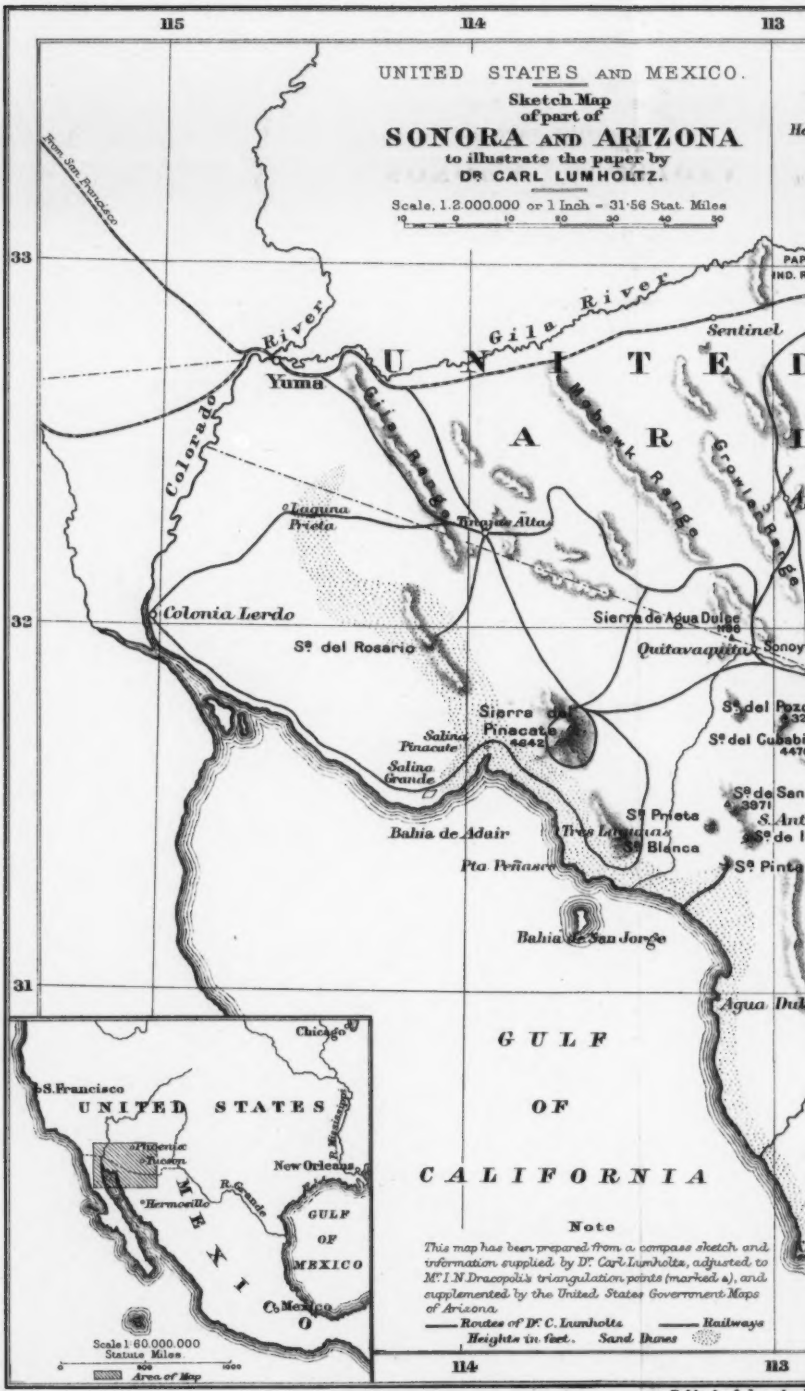
Published by the Royal Geographical So

Aberta (Ancient city)
Medina (Old Fort)
Kanatir
Site of ancient Barrage
Sumeke (Ancient city)
RIVER TIGRIS
Imam Imlek (ruins)
el Kotonia
Azizie
Samra Reshadie Canal
Kabr Hadbe
Hamadie
Tel Ajeir
Ruins
Ibrahim
Tel Reshaior
Tel Garzivat
Zebar
Tel Braitchiyeh
Nejmi (ruins)
Abu Hekab
el Nil
Hillayeh
Tower & bridge (ruins)
Tel Skurriyeh
Imbra Rashid
Sand dunes
Gades Canal
Abu Derbash
Beni Mansur
HILLA BRANCH
el Amran
el Khedr
Ibn Hassan
(dry at present date)
Shamie Can.
Mohmd Ibn Ali
Tower
Shatt Dighara
Imam Nowaja
Mounds
Ruins of Zibbleah
Sand dunes
Low ridge of mounds
Niffur (extensive ruins)
Khor el Afej (Lake Niffur)
Nabi Ishak
Yusifia Canal
Abu Fadl
Diwanie
Shatt el Afej
Shatt el Fara
(dry at present date)
Imam Hamsa
Shatt Hilla
Seyid Hassan Abu Tabich
Abu Kawara
Shat er Rumahie
(dry since 1901)
45°

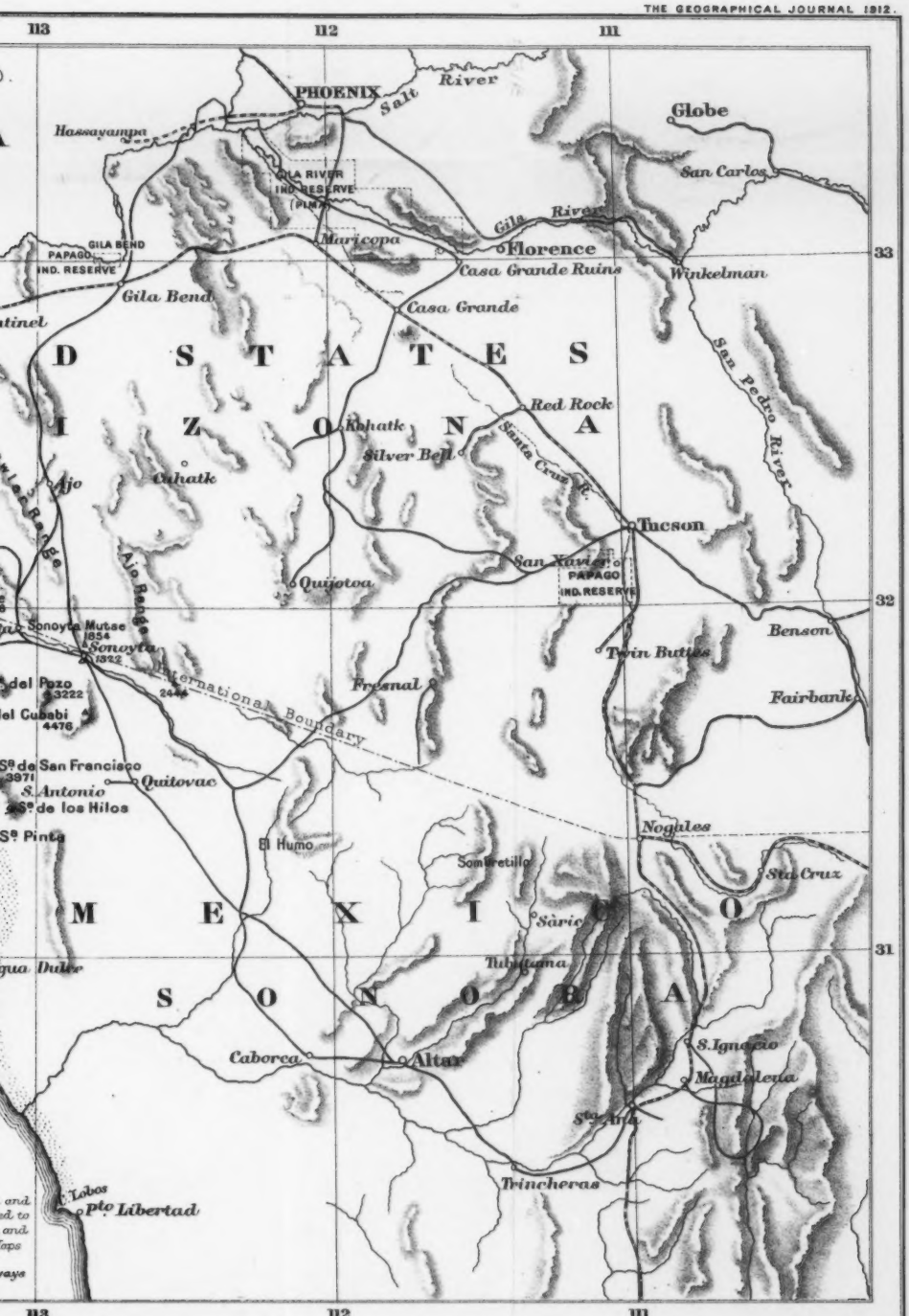
Maulawie Tower
Samarra
(Boat bridge)
Canal
Khan
Desert Falling
El Kasr Tower
Istabulat
(Ruins)
Kadsi
Khan Saiwa
270
260
250
240
230
33'
RIVER TIGRIS
To Badrai
Shadie
Imam Mahdi
Baghaila
H.F.L.
Kut el Amara
H.F.L. 57·4
W.L. 39·4
39·4
30'
Fort Nagr Fahan
Fort Tel Bisma
Fort
(ruin)
Fort
(ruin)
Shatt
40
Zenabia
Gufa ferry
Maherja
Zowcia
Imam Said Asix
Kut el Hai
Imam Tamil
Fort
Sheikh
Abd el Ali
Sheikh Said Abd
Fort
Sheikh Shirbi
Village
Imam el Agar
Fort
Hsien
32'
Jeziret
el
Heira
Fort
Fort
Suaje
(Sheikh Shahat)
Shamus
Fort
Gemireh
(Village)
Shatt el Khar
30'
46°

LOWER MESOPOTAMIA.

WILLCOCKS.



Published by the



SONORA AND ARIZONA.
Lumholtz.